



Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.8

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The primary ANTLR guy:

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Written by: Philip Hazel
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End

1.5 libiconv 1.14

1.5.1 Available under license :

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[This is the first released version of the library GPL. It is
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The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this

will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

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END OF TERMS AND CONDITIONS

Appendix: How to Apply These Terms to Your New Libraries

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1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

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GNU LIBICONV - character set conversion library

This library provides an iconv() implementation, for use on systems which don't have one, or whose implementation cannot convert from/to Unicode.

It provides support for the encodings:

European languages

ASCII, ISO-8859-{1,2,3,4,5,7,9,10,13,14,15,16},
KOI8-R, KOI8-U, KOI8-RU,
CP{1250,1251,1252,1253,1254,1257}, CP{850,866,1131},
Mac{Roman,CentralEurope,Iceland,Croatian,Romania},
Mac{Cyrillic,Ukraine,Greek,Turkish},
Macintosh

Semitic languages

ISO-8859-{6,8}, CP{1255,1256}, CP862, Mac{Hebrew,Arabic}

Japanese

EUC-JP, SHIFT_JIS, CP932, ISO-2022-JP, ISO-2022-JP-2, ISO-2022-JP-1

Chinese

EUC-CN, HZ, GBK, CP936, GB18030, EUC-TW, BIG5, CP950, BIG5-HKSCS,
BIG5-HKSCS:2004, BIG5-HKSCS:2001, BIG5-HKSCS:1999, ISO-2022-CN,
ISO-2022-CN-EXT

Korean

EUC-KR, CP949, ISO-2022-KR, JOHAB

Armenian

ARMSCII-8

Georgian

Georgian-Academy, Georgian-PS

Tajik

KOI8-T

Kazakh

PT154, RK1048

Thai

ISO-8859-11, TIS-620, CP874, MacThai

Laotian

MuleLao-1, CP1133

Vietnamese

VISCII, TCVN, CP1258

Platform specifics

HP-ROMAN8, NEXTSTEP

Full Unicode

UTF-8
UCS-2, UCS-2BE, UCS-2LE

UCS-4, UCS-4BE, UCS-4LE
UTF-16, UTF-16BE, UTF-16LE
UTF-32, UTF-32BE, UTF-32LE
UTF-7
C99, JAVA

Full Unicode, in terms of 'uint16_t' or 'uint32_t'
(with machine dependent endianness and alignment)
UCS-2-INTERNAL, UCS-4-INTERNAL
Locale dependent, in terms of 'char' or 'wchar_t'
(with machine dependent endianness and alignment, and with OS and
locale dependent semantics)
char, wchar_t
The empty encoding name "" is equivalent to "char": it denotes the
locale
dependent character encoding.

When configured with the option --enable-extra-encodings, it also provides
support for a few extra encodings:

European languages
CP{437,737,775,852,853,855,857,858,860,861,863,865,869,1125}
Semitic languages
CP864
Japanese
EUC-JISX0213, Shift_JISX0213, ISO-2022-JP-3
Chinese
BIG5-2003 (experimental)
Turkmen
TDS565
Platform specifics
ATARIST, RISCOS-LATIN1

It can convert from any of these encodings to any other, through Unicode
conversion.

It has also some limited support for transliteration, i.e. when a character
cannot be represented in the target character set, it can be approximated
through one or several similarly looking characters. Transliteration is
activated when "//TRANSLIT" is appended to the target encoding name.

libiconv is for you if your application needs to support multiple character
encodings, but that support
lacks from your system.

Installation

As usual for GNU packages:

```
$ ./configure --prefix=/usr/local
$ make
$ make install
```

After installing GNU libiconv for the first time, it is recommended to recompile and reinstall GNU gettext, so that it can take advantage of libiconv.

On systems other than GNU/Linux, the iconv program will be internationalized only if GNU gettext has been built and installed before GNU libiconv. This means that the first time GNU libiconv is installed, we have a circular dependency between the GNU libiconv and GNU gettext packages, which can be resolved by building and installing either

- first libiconv, then gettext, then libiconv again,

or (on systems supporting shared libraries, excluding AIX)

- first gettext, then libiconv, then gettext again.

Recall that before building a package for the second time, you need to erase the traces of the first build by running "make distclean".

This library can be built and installed in two variants:

- The library mode. This works on all systems, and uses a library 'libiconv.so' and a header file '<iconv.h>'. (Both are installed through "make install".)

To use it, simply #include <iconv.h> and use the functions.

To use it in an autoconfiguring package:

- If you don't use automake, append m4/iconv.m4 to your aclocal.m4 file.
- If you do use automake, add m4/iconv.m4 to your m4 macro repository.
- Add to the link command line of libraries and executables that use the functions the placeholder @LIBICONV@ (or, if using libtool for the link, @LTLIBICONV@). If you use automake, the right place for these additions are the *_LDADD variables.

Note that 'iconv.m4' is also part of the GNU gettext package, which installs it in /usr/local/share/aclocal/iconv.m4.

- The libc plug/override mode. This works on GNU/Linux, Solaris and OSF/1

systems only. It is a way to get good iconv support without having glibc-2.1.

It installs a library 'preloadable_libiconv.so'. This library can be used with LD_PRELOAD, to override the iconv* functions present in the C library.

On GNU/Linux and Solaris:

```
$ export LD_PRELOAD=/usr/local/lib/preloadable_libiconv.so
```

On OSF/1:

```
$ export _RLD_LIST=/usr/local/lib/preloadable_libiconv.so:DEFAULT
```

A program's source need not be modified, the program need not even be recompiled. Just set the LD_PRELOAD environment variable, that's it!

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Download

<http://ftp.gnu.org/gnu/libiconv/libiconv-1.14.tar.gz>

Homepage

<http://www.gnu.org/software/libiconv/>

Bug

reports to

<bug-gnu-libiconv@gnu.org>

Bruno Haible <bruno@clisp.org>

1.6 lua 5.1.5

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1.7 libpcap 1.2.1

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1.8 freefont-ttf 20100919

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Version 3, 29 June 2007

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1.11 protobuf 2.4.1

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1.12 bzip2 1.0.6

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*/

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1.13 lua 5.1.4

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```
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name and a brief idea of what it does.>  
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```

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```
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```

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```
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```

```
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1.15 iptables 1.4.20

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```
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1.16 dash 0.5.7

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1.17 libpcap 1.7.4

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1.18 libmnl 1.0.3

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30 atime=1337191922.583566431

30 ctime=1338052482.808834269

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1.19 libnfnetlink 1.0.1

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1.20 libxml2 2.9.4

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/*

* hash.c: chained hash tables

*

* Reference: Your favorite introductory book on algorithms

*

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/******

*

* \$Id\$

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*

1.21 d-bus 1.10.8

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That's all there is to it!

/* This is the public header file for the PCRE library, to be #included by applications that call the PCRE functions.

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*

* This file is part of the lwIP TCP/IP stack.

*

* Author: Adam Dunkels <adam@sics.se>

*

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```
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```

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June 26, 2010

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1.24 sqlite 3.13.0

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docs/FTL.TXT
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#
include/freetype/internal/fthash.h
#
src/base/fthash.c
src/base/md5.c
src/base/md5.h
#
src/bdf/bdf.c
src/bdf/bdf.h
src/bdf/bdfdrivr.c
src/bdf/bdfdrivr.h
src/bdf/bdferror.h
src/bdf/bdfplib.c
src/bdf/module.mk
src/bdf/README
src/bdf/rules.mk
#
```

```
src/pcf/module.mk
src/pcf/pcf.c
src/pcf/pcf.h
src/pcf/pcfdrivr.c
src/pcf/pcfdrivr.h
src/pcf/pcferror.h
src/pcf/pcfread.c
src/pcf/pcfread.h
src/pcf/pcfutil.c
src/pcf/pcfutil.h
src/pcf/README
src/pcf/rules.mk
#
src/gzip/adler32.c
src/gzip/infblock.c
src/gzip/infblock.h
src/gzip/infcodes.c
src/gzip/infcodes.h
src/gzip/inffixed.h
src/gzip/inflate.c
src/gzip/inftrees.c
src/gzip/inftrees.h
src/gzip/infutil.c
src/gzip/infutil.h
src/gzip/zconf.h
src/gzip/zlib.h
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src/tools/apinames.c
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--- end of FTL.TXT ---

1.26 logback-core 1.2.3

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1.27 e2fsprogs 1.43.7

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This is the Debian GNU/Linux prepackaged version of the static EXT2 file system consistency checker (e2fsck.static). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card

<card@masi.ibp.fr>.

Sources were obtained from <http://sourceforge.net/projects/e2fsprogs>

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Index: tdbsa/tdb.c

=====
--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

*/

/*

- Unix SMB/CIFS implementation.
+ trivial database library - standalone version

- trivial database library - private includes

-

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Gadi Oxman, August 1995

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```
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```

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```

```
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```

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This is the Debian GNU/Linux prepackaged version of the EXT2 file system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

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This package was added to the e2fsprogs debian source package by Theodore Ts'o <tytso@mit.edu> on Sat Mar 15 15:33:37 EST 2003

It is part of the main e2fsprogs distribution, which can be found at:

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#

This is a Makefile stub which handles the creation of BSD shared
libraries.

#

In order to use this stub, the following makefile variables must be defined.

#

BSDLIB_VERSION = 1.0

BSDLIB_IMAGE = libce

```

# BSDLIB_MYDIR = et
# BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#

all:: image

real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic

BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic

image: $(BSD_LIB)

$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LD_FLAGS_SHLIB) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;'`/$(BSD_LIB) $(BSD_LIB))

install-shlibs install: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LD_CONFIG)

install-strip: install

install-shlibs-strip: install-shlibs

uninstall-shlibs uninstall:
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)

clean:
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)
$(RM) -f ../$(BSD_LIB)

```

This is the Debian GNU/Linux prepackaged version of the ss command-line interface parsing library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:
tsx-11.mit.edu:/pub/linux/packages/ext2fs/

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Theodore Ts'o
23-June-2007

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That's all there is to it!

This is the Debian GNU/Linux prepackaged version of the Common Error Description library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>.

from sources obtained from a mirror of:
tsx-11.mit.edu:/pub/linux/packages/ext2fs/

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1.28 pcre 8.42

1.28.1 Available under license :

PCRE LICENCE

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End

PCRE LICENCE

PCRE is a library of functions to support regular expressions whose syntax
and semantics are as close as possible to those of the Perl 5 language.

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The basic library functions are written in C and are freestanding. Also
included in the distribution is a set of C++ wrapper functions, and a
just-in-time compiler that can be used to optimize pattern matching. These
are both optional features that can be omitted when the library is built.

THE BASIC LIBRARY FUNCTIONS

Written by: Philip Hazel
Email local part: ph10
Email domain: cam.ac.uk

University of Cambridge Computing Service,
Cambridge, England.

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PCRE JUST-IN-TIME COMPILATION SUPPORT

Written by: Zoltan Herczeg
Email local part: hzmester
Email domain: freemail.hu

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STACK-LESS JUST-IN-TIME COMPILER

Written by: Zoltan Herczeg
Email local part: hzmester
Email domain: freemail.hu

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THE C++ WRAPPER FUNCTIONS

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1.29 protobuf 3.5.1

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This file contains a list of people who've made non-trivial
contribution to the Google C++ Mocking Framework project. People
who commit code to the project are encouraged to add their names
here. Please keep the list sorted by first names.

Benoit Sigoure <tsuna@google.com>
Bogdan Piloca <boo@google.com>
Chandler Carruth <chandlerc@google.com>
Dave MacLachlan <dmaclach@gmail.com>
David Anderson <danderson@google.com>
Dean Sturtevant
Gene Volovich <gv@cite.com>
Hal Burch <gmock@hburch.com>
Jeffrey Yasskin <jyasskin@google.com>
Jim Keller <jimkeller@google.com>
Joe Walnes <joe@truemesh.com>
Jon Wray <jwray@google.com>
Keir Mierle <mierle@gmail.com>
Keith Ray <keith.ray@gmail.com>
Kostya Serebryany <kcc@google.com>
Lev Makhlis
Manuel Klimek <klimek@google.com>
Mario Tanev <radix@google.com>
Mark Paskin
Markus Heule <markus.heule@gmail.com>
Matthew Simmons <simmonmt@acm.org>
Mike Bland <mbland@google.com>
Neal Norwitz <nnorwitz@gmail.com>
Nermin Ozkiranartli <nermin@google.com>
Owen
Carlsen <ocarlsen@google.com>
Paneendra Ba <paneendra@google.com>
Paul Menage <menage@google.com>
Piotr Kaminski <piotr@google.com>
Russ Rufer <russ@pentad.com>
Sverre Sundsdal <sundsda@gmail.com>
Takeshi Yoshino <tyoshino@google.com>
Vadim Berman <vadimb@google.com>
Vlad Losev <vladl@google.com>
Wolfgang Klier <wklier@google.com>
Zhanyong Wan <wan@google.com>

This file contains a list of people who have made large contributions to the public version of Protocol Buffers.

Original Protocol Buffers design and implementation:

Sanjay Ghemawat <sanjay@google.com>

Jeff Dean <jeff@google.com>

Daniel Dulitz <daniel@google.com>

Craig Silverstein

Paul Haahr <haahr@google.com>

Corey Anderson <corin@google.com>

(and many others)

Proto2 C++ and Java primary author:

Kenton Varda <kenton@google.com>

Proto2 Python primary authors:

Will Robinson <robinson@google.com>

Petar Petrov <petar@google.com>

Java Nano primary authors:

Brian Duff <bduff@google.com>

Tom Chao <chaot@google.com>

Max Cai <maxtroy@google.com>

Ulas Kirazci <ulas@google.com>

Large code contributions:

Jason Hsueh <jasonh@google.com>

Joseph Schorr <jschorr@google.com>

Wenbo Zhu <wenboz@google.com>

Large quantity of code reviews:

Scott Bruce <sbruce@google.com>

Frank Yellin

Neal Norwitz <nnorwitz@google.com>

Jeffrey Yasskin <jyasskin@google.com>

Ambrose

Feinstein <ambrose@google.com>

Documentation:

Lisa Carey <lcarey@google.com>

Maven packaging:

Gregory Kick <gak@google.com>

Patch contributors:

Kevin Ko <kevin.s.ko@gmail.com>

* Small patch to handle trailing slashes in --proto_path flag.

Johan Euphrosine <proppy@aminche.com>

* Small patch to fix Python CallMethod().
Ulrich Kunitz <kune@deine-taler.de>
* Small optimizations to Python serialization.
Leandro Lucarella <llucax@gmail.com>
* VI syntax highlighting tweaks.
* Fix compiler to not make output executable.
Dilip Joseph <dilip.antony.joseph@gmail.com>
* Heuristic detection of sub-messages when printing unknown fields in text format.
Brian Atkinson <nairb774@gmail.com>
* Added @Override annotation to generated Java code where appropriate.
Vincent Choiniere <Choiniere.Vincent@hydro.qc.ca>
* Tru64 support.
Monty Taylor <monty.taylor@gmail.com>
* Solaris 10 + Sun Studio fixes.
Alek Storm <alek.storm@gmail.com>

* Slicing support for repeated scalar fields for the Python API.
Oleg Smolsky <oleg.smolsky@gmail.com>
* MS Visual Studio error format option.
* Detect unordered_map in stl_hash.m4.
Brian Olson <brianolson@google.com>
* gzip/zlib I/O support.
Michael Poole <mdpoole@troilus.org>
* Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).
* Added generation of field number constants.
Wink Saville <wink@google.com>
* Fixed initialization ordering problem in logging code.
Will Pierce <willp@nuclei.com>
* Small patch improving performance of in Python serialization.
Alexandre Vassalotti <alexandre@peadrop.com>
* Emacs mode for Protocol Buffers (editors/protobuf-mode.el).
Scott Stafford <scott.stafford@gmail.com>
* Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.
Alexander Melnikov <alm@sibmail.ru>
* HPUX support.
Oliver Jowett <oliver.jowett@gmail.com>
* Detect whether zlib is new enough in configure script.
* Fixes for Solaris 10 32/64-bit confusion.
Evan Jones <evanj@mit.edu>
* Optimize Java serialization code when writing a small message to a stream.
* Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
* Clean up some Java warnings.
* Fix bug with permanent callbacks that delete themselves when run.
Michael Kucharski <m.kucharski@gmail.com>
* Added CodedInputStream.getTotalBytesRead().

Kacper Kowalik <xarthisius.kk@gmail.com>
* Fixed m4/acx_pthread.m4 problem for some Linux distributions.
William Orr <will@worrbase.com>
* Fixed detection of sched_yield on Solaris.
* Added atomicops for Solaris
Andrew Paprocki <andrew@ishiboo.com>
* Fixed minor IBM xLC compiler build issues
* Added atomicops for AIX (POWER)
This file contains a list of people who've made non-trivial
contribution to the Google C++ Testing Framework project. People
who commit code to the project are encouraged to add their names
here. Please keep the list sorted by first names.

Ajay Joshi <jaj@google.com>
Balzs Dn <balazs.dan@gmail.com>
Bharat Mediratta <bharat@menalto.com>
Chandler Carruth <chandlerc@google.com>
Chris Prince <cprince@google.com>
Chris Taylor <taylorc@google.com>
Dan Egnor <egnor@google.com>
Eric Roman <eroman@chromium.org>
Hady Zalek <hady.zalek@gmail.com>
Jeffrey Yasskin <jyasskin@google.com>
Ji Sigursson <joi@google.com>
Keir Mierle <mierle@gmail.com>
Keith Ray <keith.ray@gmail.com>
Kenton Varda <kenton@google.com>
Manuel Klimek <klimek@google.com>
Markus Heule <markus.heule@gmail.com>
Mika Raento <mikie@iki.fi>
Mikls Fazekas <mfazekas@szemafor.com>
Pasi Valminen <pasi.valminen@gmail.com>
Patrick Hanna <phanna@google.com>
Patrick Riley <pfr@google.com>
Peter Kaminski <piotrk@google.com>
Preston
Jackson <preston.a.jackson@gmail.com>
Rainer Klaffenboeck <rainer.klaffenboeck@dynatrace.com>
Russ Cox <rsc@google.com>
Russ Rufer <russ@pentad.com>
Sean Mcafee <eefacm@gmail.com>
Sigurur sgeirsson <siggi@google.com>
Tracy Bialik <tracy@pentad.com>
Vadim Berman <vadimb@google.com>
Vlad Losev <vladl@google.com>
Zhanyong Wan <wan@google.com>

1.30 boost 1.67.0

1.30.1 Available under license :

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1.31 latencyutils 2.0.3

1.32 python 3.7.3

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=====

Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the

software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
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.. _history-and-license:

History and License

History of the software

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <https://www.cwi.nl/>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author,

although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <https://www.cnri.reston.va.us/>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation; see <http://www.zope.com/>). In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
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2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	no
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now	PSF	yes

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A C-program for MT19937, with initialization improved 2002/1/26.
Coded by Takuji Nishimura and Makoto Matsumoto.

Before using, initialize the state by using `init_genrand(seed)`
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Sockets

The `:mod:`socket``

module uses the functions, `:func:`getaddrinfo``, and

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UUencode and UUdecode functions

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Modified by Jack Jansen, CWI, July 1995:

- Use `binascii` module to do the actual line-by-line conversion between `ascii` and `binary`. This results in a 1000-fold speedup. The `C` version is still 5 times faster, though.
- Arguments more compliant with Python standard

XML Remote Procedure Calls

The :mod:`xmlrpc.client` module contains the following notice::

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Select kqueue

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SipHash24

The file :file:`Python/pyhash.c` contains Marek Majkowski' implementation of Dan Bernstein's SipHash24 algorithm. The contains the following note::

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Original location:

<https://github.com/majek/csiphash/>

Solution inspired by code from:

Samuel Neves (supercop/crypto_auth/siphash24/little)

djb (supercop/crypto_auth/siphash24/little2)

Jean-Philippe Aumasson

(<https://131002.net/siphash/siphash24.c>)

strtod and dtoa

The file :file:`Python/dtoa.c`, which supplies C functions dtoa and strtod for conversion of C doubles to and from strings, is derived from the file of the same name by David M. Gay, currently available from <http://www.netlib.org/fp/>. The original file, as retrieved on March 16, 2009, contains the following copyright and licensing notice::

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expat

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cfuhash

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1.33 freerdp 2.0.0-rc4

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```

```
## DO NOT EDIT - This file generated from ./build-aux/ltmain.in
```

```
##      by inline-source v2014-01-03.01
```

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```

```
# Provide generalized library-building support services.
```

```
# Written by Gordon Matzigkeit <gord@gnu.ai.mit.edu>, 1996
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/*

* FILE: sha2.c

* AUTHOR: Aaron D. Gifford - <http://www.aarongifford.com/>

*

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*

* Modified by Jelte Jansen to fit in ldns, and not clash with any

* system-defined SHA code.

* Changes:

* - Renamed (external) functions and constants to fit ldns style

* - Removed _End and _Data functions

* - Added ldns_shaX(data, len, digest) convenience functions

* - Removed prototypes of _Transform functions and made those static

*

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*

* \$Id:

sha2.c,v 1.1 2001/11/08 00:01:51 adg Exp adg \$

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/* from openssh 4.3p2 compat/strncpy.c */

/*

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/* From openssl4.3p2 compat/inet_aton.c */

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Written by: Philip Hazel
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1.43 json-c 0.12.1

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1.44 glibc 2.23

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@enumerate 0

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@subheading END OF TERMS AND CONDITIONS

@page

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(at your option) any later version.
```

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```
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```

The hypothetical commands

```
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```

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```
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Ty Coon, President of Vice
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1.51 libffi 3.2.1

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1.52 bridgeutils 1.5

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```
@end
smallexample
```

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```

```
@var{signature of Ty Coon}, 1 April 1990
Ty Coon, President of Vice
@end smallexample
```

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1.57 libvmtools 9.4.0.25793

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Any executables

containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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1.58 acpid 2.0.27

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```
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```

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```

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```
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```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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1.59 opus 1.1.2

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1.60 libvpx 1.4.0

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Authors: Loren Merritt <lorenm@u.washington.edu>

Anton Mitrofanov <BugMaster@narod.ru>

Jason Garrett-Glaser <darkshikari@gmail.com>

Henrik Gramner <hengar-6@student.ltu.se>

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Ajay Joshi <jaj@google.com>

Balzs Dn <balazs.dan@gmail.com>
Bharat Mediratta <bharat@menalto.com>
Chandler Carruth <chandlerc@google.com>
Chris Prince <cprince@google.com>
Chris Taylor <taylorc@google.com>
Dan Egnor <egnor@google.com>
Eric Roman <eroman@chromium.org>
Hady Zalek <hady.zalek@gmail.com>
Jeffrey Yasskin <jyasskin@google.com>
Ji Sigursson <joi@google.com>
Keir Mierle <mierle@gmail.com>
Keith Ray <keith.ray@gmail.com>
Kenton Varda <kenton@google.com>
Manuel Klimek <klimek@google.com>
Markus Heule <markus.heule@gmail.com>
Mika Raento <mikie@iki.fi>
Mikls Fazekas <mfazekas@szemafor.com>
Pasi Valminen <pasi.valminen@gmail.com>
Patrick Hanna <phanna@google.com>
Patrick Riley <pfr@google.com>
Peter Kaminski <piotrk@google.com>
Preston
Jackson <preston.a.jackson@gmail.com>
Rainer Klaffenboeck <rainer.klaffenboeck@dynatrace.com>
Russ Cox <rsc@google.com>
Russ Rufer <russ@pentad.com>
Sean McAfee <eefacm@gmail.com>
Sigurur sgeirsson <siggi@google.com>
Tracy Bialik <tracy@pentad.com>
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1.61 e2fsprogs 1.43.1

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*/

Index: tdbsa/tdb.c

--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

*/

/*

- Unix SMB/CIFS implementation.
+ trivial database library - standalone version

- trivial database library - private includes

-

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Gadi Oxman, August 1995

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Theodore Ts'o
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This is the Debian GNU/Linux prepackaged version of the EXT2 file system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

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This package was added to the e2fsprogs debian source package by Theodore Ts'o <tytso@mit.edu> on Sat Mar 15 15:33:37 EST 2003

It is part of the main e2fsprogs distribution, which can be found at:

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```
#
# This is a Makefile stub which handles the creation of BSD shared
# libraries.
#
# In order to use this stub, the following makefile variables must be defined.
#
# BSDLIB_VERSION = 1.0
# BSDLIB_IMAGE = libce
# BSDLIB_MYDIR = et
# BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#
```

```
all:: image
```

```
real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic
```

```
BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic
```

```
image: $(BSD_LIB)
```

```
$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS_SHLIB) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;' /$(BSD_LIB) $(BSD_LIB))
```

```
install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LDCONFIG)
```

install-strip: install

install-shlibs-strip: install-shlibs

uninstall-shlibs uninstall::

```
$(RM) -f $(DESTDIR)$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
```

clean::

```
$(RM)
```

```
-rf pic
```

```
$(RM) -f $(BSD_LIB)
```

```
$(RM) -f ../$(BSD_LIB)
```

This is the Debian GNU/Linux prepackaged version of the ss command-line interface parsing library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:
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1.62 jline 3.11.0

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1.63 cache-api 1.1.1

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1.64 popt 1.16

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1.65 opencv 4.1.1

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quirc -- QR-code recognition library

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John R. Hauser

2017 February 10


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  <!-- tree 4 -->

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      <_>
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      <!-- tree 0 -->
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    <!-- tree 0 -->
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          <_>
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<_>
<!-- root node -->

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<!-- root node -->
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    <!-- tree 0 -->
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      <!-- root node -->

```

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<!-- tree 3 -->
<_>
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    <rects>

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    <_>
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      <!-- root node -->
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<!-- root node -->
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  <!-- root node -->
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  <!-- tree 3 -->
  <_>
  <!-- root node -->

  <feature>
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        0 10 30 6 -1.</_>
      <_>

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  <!-- tree 1 -->
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  <!-- root node -->
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<_>
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<_>
<!-- root node -->
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  <!-- root node -->
  <feature>
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      <_>
      59 9 3 6 2.</_></rects>
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    <_>
    6 7 1 3 2.</_></rects>
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<_>
<!-- root node -->
<feature>
  <rects>
    <_>
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    <_>
    0 0 6 2 2.</_>
    <_>
    6 2 6 2 2.</_></rects>
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    52 12 9 2 2.</_></rects>
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<!-- tree 4 -->
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      <_>
        <!-- root node -->
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            <_>
              3 9 2 3 3.</_></rects>
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        <_>
          <!-- tree 1 -->
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            <!-- root node -->
            <feature>
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                <_>
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  <!-- root node -->
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      <_>
      41 7 8 4 3.</_></rects>
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  <!-- tree 0 -->
  <_>
  <!-- root node -->
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      <_>
      1 3 57 2 2.</_></rects>
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  </_>
  <!-- tree 1 -->
  </_>

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      </_>
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  </_>
  <!-- root node -->
  <feature>
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      </_>
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      </_>
      54 3 2 10 3.</_></rects>
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  </_>
  <!-- tree 3 -->
  </_>
  <!-- root node -->

  <feature>
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      </_>
      1 15 61 1 2.</_></rects>
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  </_>
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  </_>

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<!-- root node -->
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    <_>
      28 4 11 4 3.</_></rects>
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            22 3 41 2 2.</_></rects>
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      <!-- tree 1 -->
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        <!-- root node -->
        <feature>
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              43 6 2 8 3.</_></rects>
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        <!-- tree 2 -->
        <_>

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<!-- root node -->
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    <_>
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The current maintainer is Roland Stigge <stigge@antcom.de>

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1.66 cryptsetup 2.1.0

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Julian Seward, Cambridge, UK.

jseward@bzip.org

bzip2/libbzip2 version 1.0.4 of 20 December 2006

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1.70 inotify-tools 3.14

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Written by: Philip Hazel

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1.74 libidn 2.2.0-2

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1.83 libcap 2.22

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1.88 goprotobuf 2.4.1

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1.90 opus 1.3.1

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1.94 iproute 3.14.0

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- * Merlin Hughes
Original author of sensord.
- * Bob Schlaermann
Dynamic chip feature detection (a.k.a. generic chip support) in libsensors and sensors.
- * Mark M. Hoffman
Many improvements to the libsensors configuration file scanner.
- * Jean Delvare
New libsensors API, and migration of sensors and sensord thereto.

Many optimizations in libsensors and sensors.
Configuration file converter.
Rewrite of sensors-detect.
Support for multiple configuration files in libsensors.

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1.100 liblogging 1.0.3

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1.102 libva 1.0.15

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Upstream Author(s):

Waldo Bastian <waldo.bastian@intel.com>

Jonathan Bian <jonathan.bian@intel.com>

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1.103 tftp-hpa 5.2

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1.104 libcap-ng 0.7.9-2.1build1

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1.110 icu 65

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## Commands to generate dependency files  
GEN_DEPS.c= $(CC) -E -MM $(DEFS) $(CPPFLAGS)
```

```

GEN_DEPS.cc= $(CXX) -E -MM $(DEFS) $(CPPFLAGS)

## Flags for position independent code
SHAREDLIBCFLAGS = -fPIC
SHAREDLIBCXXFLAGS = -fPIC
SHAREDLIBCPPFLAGS = -DPIC

## Additional flags when building libraries and with threads
THREADSCPPFLAGS = -D_REENTRANT
LIBCPPFLAGS =

## Compiler switch to embed a runtime search path
LD_RPATH=
LD_RPATH_PRE= -Wl,-rpath,

## Compiler switch to embed a library name
LD_SONAME = -Wl,-soname -Wl,$(notdir $(MIDDLE_SO_TARGET))

## Shared library options
LD_SOOPTIONS= -Wl,-Bsymbolic

## Shared object suffix
SO = so

## Non-shared intermediate object suffix
STATIC_O = ao

## Compilation
rules
%. $(STATIC_O): $(srcdir)/%.c
$(COMPILE.c) $(STATICCPPFLAGS) $(STATICCFLAGS) -o $@ $<
%.o: $(srcdir)/%.c
$(COMPILE.c) $(DYNAMICCPPFLAGS) $(DYNAMICCFLAGS) -o $@ $<

%. $(STATIC_O): $(srcdir)/%.cpp
$(COMPILE.cc) $(STATICCPPFLAGS) $(STATICCXXFLAGS) -o $@ $<
%.o: $(srcdir)/%.cpp
$(COMPILE.cc) $(DYNAMICCPPFLAGS) $(DYNAMICCXXFLAGS) -o $@ $<

## Dependency rules
%.d: $(srcdir)/%.c
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.c) $< \
| sed "s^\($*\)\.o[ :]*/1.o $@ :/g" > $@; \
[ -s $@ ] || rm -f $@'

%.d: $(srcdir)/%.cpp
@echo "generating dependency information for $<"

```

```
@$(SHELL) -ec '$(GEN_DEPS.cc) $< \  
| sed \"s/^(.*)\.o[ :]*^1.o $@ :/g\" > $@; \  
[ -s $@ ] || rm -f $@'
```

Versioned libraries rules

```
%. $(SO).$(SO_TARGET_VERSION_MAJOR): %. $(SO).$(SO_TARGET_VERSION)  
$(RM) $@ && ln -s ${<F} $@  
%. $(SO): %. $(SO).$(SO_TARGET_VERSION_MAJOR)  
$(RM) $@ && ln -s ${*F}. $(SO).$(SO_TARGET_VERSION) $@
```

Bind internal references

```
# LDflags that pkgdata will use  
BIR_LDFLAGS= -Wl,-Bsymbolic
```

```
# Dependencies [i.e. map files] for the final library  
BIR_DEPS=
```

```
## Remove shared library 's'  
STATIC_PREFIX_WHEN_USED =  
STATIC_PREFIX =
```

```
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```

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@subheading END OF TERMS AND CONDITIONS

@page

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1.113 dom4j 2.1.3

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- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementQNameIterator.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementIterator.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/ElementHandler.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/CDATA.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Document.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/Action.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Comment.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Entity.java
- *
- */opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/bean/BeanDocumentFactory.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightCDATA.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/IllegalAddException.java

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 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/Pattern.java
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 jar/org/dom4j/rule/pattern/NodeTypePattern.java
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 /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/dtd/ExternalEntityDecl.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/swing/XMLTableDefinition.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/jaxb/JAXBWriter.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/bean/BeanAttribute.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/tree/AbstractCDATA.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/swing/DocumentTreeModel.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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 jar/org/dom4j/DocumentType.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/tree/ContentListFacade.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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 jar/org/dom4j/util/UserDataAttribute.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Visitor.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/io/SAXWriter.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Node.java
 *
 /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Attribute.java
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 jar/org/dom4j/swing/XMLTableModel.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
 jar/org/dom4j/dom/DOMProcessingInstruction.java
 * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/Mode.java

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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Namespace.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/DefaultProcessingInstruction.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/FlyweightComment.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/jaxb/JAXBRuntimeException.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/tree/AbstractBranch.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
jar/org/dom4j/io/HTMLWriter.java
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/opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dtd/InternalEntityDecl.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/DatatypeElementFactory.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultComment.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMCDATA.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifier.java
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/opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBObjectModifier.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBReader.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/ElementModifier.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMAttributeNodeMap.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/XMLResult.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyReader.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/xpp/ProxyXmlStartTag.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dtd/AttributeDecl.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DocumentInputSource.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractDocumentType.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/DocumentException.java


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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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jar/org/dom4j/io/JAXPHelper.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Branch.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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/opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Element.java
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1.114 jquery 3.5.1

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This code is derived from section 17.1 of Applied Cryptography, second edition, which describes a stream cipher allegedly compatible with RSA Labs "RC4" cipher (the actual description of which is a trade secret). The same algorithm is used as a stream cipher called "arcfour" in Tatu Ylonen's ssh package.

Here the stream cipher has been modified always to include the time when initializing the state. That makes it impossible to regenerate the same random sequence twice, so this can't be used for encryption, but will generate good random numbers.

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To compute the message digest of a chunk of bytes, declare an MD5Context structure, pass it to MD5Init, call MD5Update as needed on buffers full of bytes, and then call MD5Final, which

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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Utils.java

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/opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInfoGenerator.java

* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInfoGenerator.java

* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ThrowsTypeTarget.java

* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/TypeParameterBoundTypeTarget.java

* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/EmptyTypeTarget.java

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*

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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/VoidType.java

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*

/opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInternal.java

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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/UnresolvedTypeVariable.java
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jar/org/jboss/jandex/PackedDataOutputStream.java  
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-  
jar/org/jboss/jandex/ClassInfo.java  
*  
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jar/org/jboss/jandex/IndexWriter.java  
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jar/org/jboss/jandex/DotName.java  
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jar/org/jboss/jandex/FieldInternal.java  
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-  
jar/org/jboss/jandex/FieldInfo.java  
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jar/org/jboss/jandex/NameTable.java  
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-  
jar/org/jboss/jandex/CompositeIndex.java  
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-  
jar/org/jboss/jandex/IndexWriterV1.java  
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-  
jar/org/jboss/jandex/IndexView.java  
*
```


/opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/StrongInternPool.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Indexer.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/JarIndexer.java
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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInfo.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReaderV1.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Result.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Index.java
*
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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationValue.java
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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/PrimitiveType.java
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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Type.java

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The following individuals contributed in part to the Network Time
 Protocol Distribution

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 work.

1. [1]Takao Abe <takao_abe@xurb.jp> Clock driver for JJY receivers
 2. [2]Mark Andrews <mark_andrews@isc.org> Leitch atomic clock
 controller
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 10. [11]Nelson B Bolyard <nelson@bolyard.me> update and complete
 broadcast and crypto features
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11. [12]Jean-Francois Boudreault
 <Jean-Francois.Boudreault@viagenie.qc.ca> IPv6 support
 12. [13]Reg Clemens <reg@dwf.com> Oncore driver (Current maintainer)
 13. [14]Steve Clift <clift@ml.csiro.au> OMEGA clock driver
 14. [15]Casey Crellin <casey@csc.co.za> vxWorks (Tornado) port and help
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 clock driver, NT adj. residuals, integrated Greg's Winnt port.
 16. [17]John A. Dundas III <dundas@salt.jpl.nasa.gov> Apple A/UX port
 17. [18]Torsten Duwe <duwe@immd4.informatik.uni-erlangen.de> Linux port
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 19. [20]John Hay <jhay@icomtek.csir.co.za> IPv6 support and testing

20. [21]Dave Hart <davehart@davehart.com> General maintenance, Windows port interpolation rewrite
21. [22]Claas Hilbrecht <neoclock4x@linum.com> NeoClock4X clock driver
22. [23]Glenn Hollinger <glenn@herald.usask.ca> GOES clock driver
23. [24]Mike Iglesias <iglesias@uci.edu> DEC Alpha port
24. [25]Jim Jagielski <jim@jagubox.gsfc.nasa.gov> A/UX port
25. [26]Jeff Johnson <jbj@chatham.usdesign.com> massive prototyping overhaul
26. [27]Hans Lambermont <Hans.Lambermont@nl.origin-it.com> or [28]<H.Lambermont@chello.nl> ntpsweep
27. [29]Poul-Henning Kamp <phk@FreeBSD.ORG> Oncore driver (Original author)
28. [30]Frank Kardel [31]<kardel (at) ntp (dot) org> PARSE <GENERIC> (driver 14 reference clocks), STREAMS modules for PARSE, support scripts, syslog cleanup, dynamic interface handling
29. [32]Johannes Maximilian Kuehn <kuehn@ntp.org> Rewrote sntp to comply with NTPv4 specification, ntpq saveconfig
30. [33]William L. Jones <jones@hermes.chpc.utexas.edu> RS/6000 AIX modifications, HPUX modifications
31. [34]Dave Katz <dkatz@cisco.com> RS/6000 AIX port
32. [35]Craig Leres <leres@ee.lbl.gov> 4.4BSD port, ppsclock, Magnavox GPS clock driver
33. [36]George Lindholm <lindholm@ucs.ubc.ca> SunOS 5.1 port
34. [37]Louis A. Mamakos <louie@ni.umd.edu> MD5-based authentication
35. [38]Lars H. Mathiesen <thorinn@diku.dk> adaptation of foundation code for Version 3 as specified in RFC-1305
36. [39]Danny Mayer <mayer@ntp.org>Network I/O, Windows Port, Code Maintenance
37. [40]David L. Mills <mills@udel.edu> Version 4 foundation, precision kernel; clock drivers: 1, 3, 4, 6, 7, 11, 13, 18, 19, 22, 36
38. [41]Wolfgang Moeller <moeller@gwdgv1.dnet.gwdg.de> VMS port
39. [42]Jeffrey Mogul <mogul@pa.dec.com> ntptrace utility
40. [43]Tom Moore <tmoore@fivel.daytonoh.ncr.com> i386 svr4 port
41. [44]Kamal A Mostafa <kamal@whence.com> SCO OpenServer port
42. [45]Derek Mulcahy <derek@toybox.demon.co.uk> and [46]Damon Hart-Davis <d@hd.org> ARCRON MSF clock driver
43. [47]Rob Neal <neal@ntp.org> Bancomm refclock and config/parse code maintenance
44. [48]Rainer Pruy <Rainer.Pruy@informatik.uni-erlangen.de> monitoring/trap scripts, statistics file handling
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47. [51]Nick Sayer <mrapple@quack.kfu.com> SunOS streams modules
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49. [53]Ray Schnitzler <schnitz@unipress.com> Unixware1 port
 50. [54]Michael Shields <shields@tembel.org> USNO clock driver
 51. [55]Jeff Steinman <jss@pebbles.jpl.nasa.gov> Datum PTS clock driver
 52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure
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 53. [57]Kenneth Stone <ken@sdd.hp.com> HP-UX port
 54. [58]Ajit Thyagarajan <ajit@ee.udel.edu>IP multicast/anycast support
 55. [59]Tomoaki TSURUOKA <tsuruoka@nc.fukuoka-u.ac.jp>TRAK
clock driver
 56. [60]Brian Utterback <brian.utterback@oracle.com> General codebase,
Solaris issues
 57. [61]Loganaden Velvindron <loganaden@gmail.com> Sandboxing
(libseccomp) support
 58. [62]Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic
TrueTime clock driver
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validated HTML documents according to the HTML DTD
-

References

1. mailto:%20takao_abe@xurb.jp
2. mailto:%20mark_andrews@isc.org
3. mailto:%20altmeier@atsoft.de
4. mailto:%20vbais@mailman1.intel.co
5. mailto:%20kirkwood@striderfm.intel.com
6. mailto:%20michael.barone@lmco.com
7. mailto:%20karl@owl.HQ.ileaf.com
8. mailto:%20greg.brackley@bigfoot.com
9. mailto:%20Marc.Brett@westgeo.com
10. mailto:%20Piete.Brooks@cl.cam.ac.uk
11. mailto:%20nelson@bolyard.me
12. mailto:%20Jean-Francois.Boudreault@viagenie.qc.ca
13. mailto:%20reg@dwf.com
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16. mailto:%20Sven_Dietrich@trimble.COM
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18. mailto:%20duwe@immd4.informatik.uni-erlangen.de
19. mailto:%20dennis@mrbill.canet.ca
20. mailto:%20jhay@icomtek.csir.co.za
21. mailto:%20davehart@davehart.com
22. mailto:%20neoclock4x@linum.com
23. mailto:%20glenn@herald.usask.ca
24. mailto:%20iglesias@uci.edu
25. mailto:%20jagubox.gsfc.nasa.gov
26. mailto:%20jbj@chatham.usdesign.com
27. mailto:%20Hans.Lambermont@nl.origin-it.com

28. <mailto:H.Lambermont@chello.nl>
29. <mailto:%20phk@FreeBSD.ORG>
30. <http://www4.informatik.uni-erlangen.de/%7ekardel>
31. <mailto:%20kardel%20%28at%29%20ntp%20%28dot%29%20org>
32. <mailto:kuehn@ntp.org>
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36. <mailto:%20lindholm@ucs.ubc.ca>
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38. <mailto:%20thorinn@diku.dk>
39. <mailto:%20mayer@ntp.org>
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41. <mailto:%20moeller@gwdgv1.dnet.gwdg.de>
42. <mailto:%20mogul@pa.dec.com>
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44. <mailto:%20kamal@whence.com>
45. <mailto:%20derek@toybox.demon.co.uk>
46. <mailto:%20d@hd.org>
47. <mailto:%20neal@ntp.org>
48. <mailto:%20Rainer.Pruy@informatik.uni-erlangen.de>
49. <mailto:%20dirce@zk3.dec.com>
50. <mailto:%20wsanchez@apple.com>
51. <mailto:%20mrapple@quack.kfu.com>
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1.120 dhcpcd 9.1.1

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- javaee_web_services_client_1_2.xsd
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- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- jsp_2_2.xsd
- web-app_3_0.xsd
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- web-common_3_1.xsd
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Schemas for Java EE Deployment Descriptors:

- javaee_5.xsd
- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- jsp_2_2.xsd
- web-app_3_0.xsd
- web-common_3_0.xsd
- web-fragment_3_0.xsd
- javaee_7.xsd
- javaee_web_services_1_4.xsd
- javaee_web_services_client_1_4.xsd
- jsp_2_3.xsd
- web-app_3_1.xsd
- web-common_3_1.xsd
- web-fragment_3_1.xsd
- javaee_8.xsd
- web-app_4_0.xsd
- web-common_4_0.xsd
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The original XML Schemas for Java EE Deployment Descriptors:

- javaee_5.xsd
- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- jsp_2_2.xsd

- web-app_3_0.xsd
- web-common_3_0.xsd
- web-fragment_3_0.xsd
- javaee_7.xsd
- javaee_web_services_1_4.xsd
- javaee_web_services_client_1_4.xsd
- jsp_2_3.xsd
- web-app_3_1.xsd
- web-common_3_1.xsd
- web-fragment_3_1.xsd
- javaee_8.xsd
- web-app_4_0.xsd
- web-common_4_0.xsd
- web-fragment_4_0.xsd

may be obtained from:

<http://www.oracle.com/webfolder/technetwork/jsc/xml/ns/javaee/index.html>

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1.126 ffmpeg 4.3.1

1.126.1 Available under license :

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these parts are used by default, you have to explicitly pass `--enable-gpl` to configure to activate them. In this case, FFmpeg's license changes to GPL v2+.

Specifically, the GPL parts of FFmpeg are:

- libpostproc
- optional x86 optimization in the files
 - `libavcodec/x86/flac_dsp_gpl.asm`
 - `libavcodec/x86/idct_mmx.c`
 - `libavfilter/x86/vf_removegrain.asm`
- the following building and testing tools
 - `compat/solaris/make_sunver.pl`
 - `doc/t2h.pm`
 - `doc/texi2pod.pl`
 - `libswresample/tests/swresample.c`
 - `tests/checkasm/*`
 - `tests/tiny_ssim.c`

-

the following filters in libavfilter:

- `signature_lookup.c`
- `vf_blackframe.c`
- `vf_boxblur.c`
- `vf_colormatrix.c`
- `vf_cover_rect.c`
- `vf_croptdetect.c`
- `vf_delogo.c`
- `vf_eq.c`
- `vf_find_rect.c`
- `vf_fspp.c`
- `vf_histeq.c`
- `vf_hqdn3d.c`
- `vf_kerndeint.c`
- `vf_lensfun.c` (GPL version 3 or later)
- `vf_mcdeint.c`
- `vf_mpdecimate.c`
- `vf_nnedi.c`
- `vf_owdenoise.c`
- `vf_perspective.c`
- `vf_phase.c`
- `vf_pp.c`
- `vf_pp7.c`
- `vf_pullup.c`
- `vf_repeatfields.c`
- `vf_sab.c`
- `vf_signature.c`
- `vf_smartblur.c`
- `vf_spp.c`
- `vf_stereo3d.c`

- `vf_super2xsai.c`
- `vf_tinterlace.c`
- `vf_uspp.c`
- `vf_vaguedenoiser.c`
- `vsrc_mptestsrc.c`

Should you, for whatever reason, prefer to use version 3 of the (L)GPL, then the configure parameter `--enable-version3` will activate this licensing option for you. Read the file `COPYING.LGPLv3` or, if you have enabled GPL parts, `COPYING.GPLv3` to learn the exact legal terms that apply in this case.

There are a handful of files under other licensing terms, namely:

- * The files `libavcodec/jfdctfst.c`, `libavcodec/jfdctint_template.c` and `libavcodec/jrevdct.c` are taken from libjpeg, see the top of the files for licensing details. Specifically note that you must credit the IJG in the documentation accompanying your program if you only distribute executables. You must also indicate any changes including additions and deletions to those three files in the documentation.
- * `tests/reference.pnm` is under the expat license.

External libraries

FFmpeg can be combined with a number of external libraries, which sometimes affect the licensing of binaries resulting from the combination.

Compatible libraries

The following libraries are under GPL version 2:

- avisynth
- frei0r
- libcdio
- libdavs2
- librubberband
- libvidstab
- libx264
- libx265
- libxavs
-
- libxavs2
- libxvid

When combining them with FFmpeg, FFmpeg needs to be licensed as GPL as well by passing `--enable-gpl` to configure.

The following libraries are under LGPL version 3:

- gmp
- libaribb24
- liblensfun

When combining them with FFmpeg, use the configure option `--enable-version3` to upgrade FFmpeg to the LGPL v3.

The VMAF, mbedTLS, RK MPI, OpenCORE and VisualOn libraries are under the Apache License 2.0. That license is incompatible with the LGPL v2.1 and the GPL v2, but not with version 3 of those licenses. So to combine these libraries with FFmpeg, the license version needs to be upgraded by passing `--enable-version3` to configure.

The smbclient library is under the GPL v3, to combine it with FFmpeg, the options `--enable-gpl` and `--enable-version3` have to be passed to configure to upgrade FFmpeg to the GPL v3.

Incompatible libraries

There are certain libraries you can combine with FFmpeg whose licenses are not compatible with the GPL and/or the LGPL. If you wish to enable these libraries, even in circumstances that their license may be incompatible, pass `--enable-nonfree` to configure. This will cause the resulting binary to be unredistributable.

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1.127 spring-security-web 5.3.4.RELEASE

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```
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jar/org/springframework/security/web/server/header/ReferrerPolicyServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/http/SecurityHeaders.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/logout/HttpStatusReturningServerLogoutSuccessHandle
r.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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jar/org/springframework/security/web/server/authentication/ServerAuthenticationConverter.java
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jar/org/springframework/security/web/reactive/result/method/annotation/AuthenticationPrincipalArgumentResolver.
java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authorization/ServerWebExchangeDelegatingServerAccessDeniedHan
dler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/ServerHttpBasicAuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/ForwardLogoutSuccessHandler.java
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jar/org/springframework/security/web/context/request/async/SecurityContextCallableProcessingInterceptor.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerFormLoginAuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/DelegatingServerAuthenticationSuccessHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/context/WebSessionServerSecurityContextRepository.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ui/DefaultLogoutPageGeneratingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/SimpleUrlAuthenticationFailureHandler.java
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jar/org/springframework/security/web/reactive/result/view/CsrfRequestData ValueProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ForwardAuthenticationFailureHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/csrf/CsrfServerLogoutHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/FeaturePolicyServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/XXssProtectionServerHttpHeadersWriter.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/firewall/FirewalledResponse.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/authentication/ui/DefaultLoginPageGeneratingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ExceptionMappingAuthenticationFailureHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ForwardAuthenticationSuccessHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerX509AuthenticationConverter.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/util/matcher/NegatedServerWebExchangeMatcher.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/CacheControlHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/AbstractPreAuthenticatedProcessingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/StaticServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/RequestMatcherDelegatingAccessDeniedHandler.java
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jar/org/springframework/security/web/server/authentication/AnonymousAuthenticationWebFilter.java
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jar/org/springframework/security/web/server/MatcherSecurityWebFilterChain.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/logout/DelegatingServerLogoutHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerHttpBasicAuthenticationConverter.java
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jar/org/springframework/security/web/util/matcher/RequestVariablesExtractor.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/Enumerator.java

*

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/DefaultWebInvocationPrivilegeEvaluator.java

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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/SavedRequestAwareWrapper.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/ChannelProcessingFilter.java

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 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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 jar/org/springframework/security/web/access/channel/ChannelDecisionManagerImpl.java
 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
 jar/org/springframework/security/web/access/intercept/FilterSecurityInterceptor.java
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 jar/org/springframework/security/web/access/channel/SecureChannelProcessor.java
 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
 jar/org/springframework/security/web/authentication/NullRememberMeServices.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/intercept/DefaultFilterInvocationSecurityMetadataSource.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/AnonymousAuthenticationFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/www/NonceExpiredException.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/HttpSessionCreatedEvent.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/HttpSessionDestroyedEvent.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/PortMapper.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestWrapper.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/InsecureChannelProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/switchuser/SwitchUserGrantedAuthority.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/FilterChainProxy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/FilterInvocation.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/ChannelProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/LogoutFilter.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationFilter.java
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jar/org/springframework/security/web/jaasapi/JaasApiIntegrationFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/DelegatingAuthenticationEntryPoint.java
*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/ELRequestMatcher.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/RequestMatcherEditor.java
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jar/org/springframework/security/web/server/authorization/AuthorizationContext.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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jar/org/springframework/security/web/server/authorization/AuthorizationWebFilter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/WebFilterChainProxy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/logout/ServerLogoutHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/WebFilterChainServerAuthenticationSuccessHandler.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/CsrfException.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/HttpBasicServerAuthenticationEntryPoint.java
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/context/SecurityContextServerWebExchange.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/ui/LogoutPageGeneratingWebFilter.java
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authorization/DelegatingReactiveAuthorizationManager.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/RedirectServerAuthenticationSuccessHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/savedrequest/NoOpServerRequestCache.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/WebFilterExchange.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/CsrfToken.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/context/SecurityContextServerWebExchangeWebFilter.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/ServerAuthenticationEntryPoint.java
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jar/org/springframework/security/web/jackson2/DefaultCsrfTokenMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/DefaultSavedRequestMixin.java
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jar/org/springframework/security/web/session/SessionInformationExpiredStrategy.java
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jar/org/springframework/security/web/jackson2/CookieDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/CookieMixin.java
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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jar/org/springframework/security/web/header/writers/ContentSecurityPolicyHeaderWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/AuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/matcher/AntPathRequestMatcher.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/servletapi/HttpServletRequestRequestFactory.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/ThrowableCauseExtractor.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/RequestHeaderAuthenticationFilter.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/x509/X509PrincipalExtractor.java

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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/context/NullSecurityContextRepository.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/rememberme/InvalidCookieException.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/NullRequestCache.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/SimpleRedirectInvalidSessionStrategy.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/writers/frameoptions/StaticAllowFromStrategy.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/context/request/async/WebAsyncManagerIntegrationFilter.java

*

/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/HttpStatusReturningLogoutSuccessHandler.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedGrantedAuthoritiesWebAuthenticationDetails.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/debug/Logger.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/writers/frameoptions/RegExpAllowFromStrategy.java

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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/DelegatingLogoutSuccessHandler.java

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/websphere/WebSpherePreAuthenticatedProcessingFilter.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/InvalidSessionStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/AbstractRetryEntryPoint.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationException.java
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*
/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/WebExpressionVoter.java
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 jar/org/springframework/security/web/bind/annotation/AuthenticationPrincipal.java
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jar/org/springframework/security/web/authentication/session/SessionFixationProtectionEvent.java
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jar/org/springframework/security/web/method/annotation/CsrfTokenArgumentResolver.java
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/opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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```
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/DefaultJaasAuthenticationProvider.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/AbstractJaasAuthenticationProvider.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/memory/InMemoryConfiguration.java
```

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 */
/**
 *
 * @param authentication represents the user in question. Should not be null.
 * @param targetDomainObject the domain object for which permissions should be
 * checked. May be null in which case implementations should return false, as the null
 * condition can be checked explicitly in the expression.
 *
 * @param permission a representation of the permission object as supplied by the
 * expression system. Not null.
 * @return true if the permission is granted, false otherwise
 */
```

Found in path(s):

```
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/PermissionEvaluator.java
```

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*/

/**

* Base64 encoder which is a reduced version of Robert Harder's public domain
* implementation (version 2.3.7). See <http://iharder.sourceforge.net/current/java/base64/>
* <http://iharder.sourceforge.net/current/java/base64/> for more information.

* <p>

* For internal use only.

*

* @author

Luke Taylor

* @since 3.0

* @deprecated Use java.util.Base64

*/

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/codec/Base64.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/DefaultAuthenticationEventPublisher.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/MethodSecurityEvaluationContext.java
*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ProviderManager.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Digester.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/context/ReactiveSecurityContextHolder.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthorizationDecision.java

*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/PasswordEncoderUtils.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManager.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsService.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthenticatedReactiveAuthorizationManager.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Md4.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/factory/PasswordEncoderFactories.java

*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/SpringSecurityCoreVersion.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/ReactiveAuthorizationManager.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/AuthenticatedPrincipal.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/parameters/P.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/MapReactiveUserDetailsService.java

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- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenDeserializer.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UserDeserializer.java

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*/

/**

- * A token issued by { @link TokenService }.

*

- * <p>

- * It is important that the keys assigned to tokens are sufficiently randomised and

- * secured that they can serve as identifying a unique user session. Implementations of

- * { @link TokenService } are free to use encryption or encoding strategies of their choice.

- * It is strongly recommended that keys are of sufficient length to balance safety against

- * persistence cost. In relation to persistence cost, it is strongly recommended that

- * returned keys are small enough for encoding in a cookie.

- * </p>

*

- * @author Ben Alex

- * @since 2.0.1

*/

Found in path(s):

- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/core/token/Token.java

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 */
/**
 * Determines if the {@link #getAuthentication()} has permission to access the target
 * given the permission
 * @param target the target domain object to check permission on
 * @param permission the permission to check on the domain object (i.e. "read",
 * "write", etc).
 * @return true if permission
 is granted to the {@link #getAuthentication()}, else
 * false
 */
```

Found in path(s):

`/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/SecurityExpressionOperations.java`

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/bcrypt/BCryptPasswordEncoder.java

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*/
/**
* Reviews the Object returned from a secure object invocation, being able to
* modify the Object or throw an { @link AccessDeniedException}.
* <p>
* Typically used to ensure the principal is permitted to access the domain object
* instance returned by a service layer bean.
* Can also be used to mutate the domain object
* instance so the principal is only able to access authorised bean properties or
* Collection elements.
* <p>
* Special consideration should be given to using an AfterInvocationManager
* on bean methods that modify a database. Typically an
* AfterInvocationManager is used with read-only methods, such as
* public DomainObject getById(id). If used with methods that modify a
* database, a transaction manager should be used to ensure any
* AccessDeniedException will cause a rollback of the changes made by the
* transaction.
* </p>
*
* @author Ben Alex
*/

```

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```

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/AfterInvocationManager.java

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*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/UserDetailsPasswordService.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerResolver.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AbstractUserDetailsReactiveAuthenticationManager.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/argon2/Argon2EncodingUtils.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/SecureRandomFactoryBean.java

*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/ExpressionBasedPreInvocationAdvice.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/event/LogoutSuccessEvent.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/UserDetailsRepositoryReactiveAuthenticationManager.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/annotation/CurrentSecurityContext.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyImpl.java

*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerAdapter.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AuthenticationManagerResolver.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/SecureRandomBytesKeyGenerator.java

*

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/HexEncodingTextEncryptor.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/TextEncryptor.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/HexEncodingStringKeyGenerator.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/StandardPasswordEncoder.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/NoOpPasswordEncoder.java

*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BouncyCastleAesCbcBytesEncryptor.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/CipherUtils.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/SharedKeyGenerator.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BouncyCastleAesBytesEncryptor.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/StringKeyGenerator.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/KeyGenerators.java

*

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BytesEncryptor.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BouncyCastleAesGcmBytesEncryptor.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UserMixin.java
*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UnmodifiableSetDeserializer.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/AccessDecisionVoter.java

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 * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/access/prepost/PreInvocationAttribute.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/access/expression/method/ExpressionBasedPostInvocationAdvice.java

* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/core/token/TokenService.java

1.129 ical4j 3.0.19

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1.131 jaxb-core 2.3.3

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1.132 Icms 2.11

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1.135 fdisk 1.1.0

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/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/CompositeMigrationResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/CockroachRetryingTransactionalExecutionTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/Database.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/FileCopyUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbyDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/clazz/ClassProvider.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/package-info.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/ExceptionUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/cockroachdb/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/schemahistory/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/filesystem/FileSystemScanner.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbySchema.java
*

/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/logging/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/base/SchemaObject.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/schemahistory/JdbcTableSchemaHistory.java
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/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/informix/InformixConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/jboss/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/CloseableIterator.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/ExecutionTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/executor/Context.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/migration/JavaMigration.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/Scanner.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/configuration/ConfigUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLogCreator.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Schema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarFileClassPathLocationScanner.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/PeekingReader.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/ResourceNameCache.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/DbClean.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/PositionTrackingReader.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/MigrationInfoService.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeSchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeConnection.java
*

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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv2UrlResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Database.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/Statement.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/android/ContextHolder.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLSchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBParser.java
*
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/configuration/ClassicConfiguration.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceProvider.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/ErrorCode.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleResults.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/MigrationInfoContext.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/LocationScannerCache.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlserver/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/schemahistory/AppliedMigration.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleSqlScriptExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/callback/CallbackExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBSchema.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/package-info.java
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 jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLParser.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-

jar/org/flywaydb/core/internal/sqlscript/SqlStatementIterator.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/logging/slf4j/Slf4jLog.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBRetryingStrategy.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/callback/Error.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/parser/RecordingReader.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/migration/Context.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBConnection.java
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 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/FlywayException.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/base/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLog.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/logging/slf4j/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/db2/DB2Database.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/package-
 info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/command/DbRepair.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/firebird/FirebirdParser.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/parser/Parser.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/jdbc/PlainExecutionTemplate.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/info/MigrationInfoDumper.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resource/ResourceName.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/mysql/MySQLDatabase.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/base/Type.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/base/Table.java
 *
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 jar/org/flywaydb/core/api/configuration/FluentConfiguration.java

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/util/Locations.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resolver/MigrationInfoHelper.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/informix/InformixSchema.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/logging/Log.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLType.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/sqlscript/ParsedSqlStatement.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/logging/android/AndroidLog.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/sqlscript/SqlScriptFactory.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/license/FlywayProUpgradeRequiredException.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/logging/LogFactory.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resolver/java/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/base/Function.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/util/AsciiTable.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/mysql/MySQLNamedLockTemplate.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/callback/DefaultCallbackExecutor.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/resolver/ResolvedMigration.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/exception/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-

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jar/org/flywaydb/core/internal/info/MigrationInfoServiceImpl.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/configuration/Configuration.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/informix/InformixDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/derby/DerbyConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/command/DbMigrate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/MigrationInfo.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/base/Connection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/jdbc/ErrorImpl.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/firebird/FirebirdConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/DateUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/callback/NoopCallbackExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/DatabaseExecutionStrategy.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutorFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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*
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/output/InfoOutputFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/jdbc/Results.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/db2/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutorFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/callback/SqlScriptCallbackFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerEngineEdition.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/command/DbBaseline.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/SqlCallable.java

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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/informix/InformixTable.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLAdvisoryLockTemplate.java
 *
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 *
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 *
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/logging/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-

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jar/org/flywaydb/core/api/callback/Callback.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/scanner/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/callback/BaseCallback.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabase.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/mysql/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resolver/sql/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/saphana/SAPHANAParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/output/package-info.java

```

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/derby/DerbyParser.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/schemahistory/SchemaHistoryFactory.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/sqlscript/FlywaySqlScriptException.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/saphana/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationResolver.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/DatabaseFactory.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/redshift/RedshiftTable.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/DefaultExecutionStrategy.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resource/NoopResourceProvider.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/parser/TokenType.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/db2/DB2Function.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/h2/H2Connection.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/resource/classpath/ClassPathResource.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/parser/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/api/resolver/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLCopyParsedStatement.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/clazz/package-info.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/scanner/classpath/OsgiClassPathLocationScanner.java
 *
 /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/firebird/FirebirdTable.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/scanner/classpath/ResourceAndClassScanner.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/database/sybasease/SybaseASEDatabase.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
 jar/org/flywaydb/core/internal/parser/Token.java
 * /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-

jar/org/flywaydb/core/internal/jdbc/JdbcTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/android/package-info.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/info/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/resolver/ChecksumMatcher.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/resolver/MigrationResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/configuration/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resolver/java/FixedJavaMigrationResolver.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/jdbc/ExecutionTemplateFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/executor/MigrationExecutor.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/sqlscript/Delimiter.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/Location.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/jdbc/JdbcConnectionFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/ResourceType.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/callback/Context.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/configuration/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sybasease/SybaseASEParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/package-info.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/sqlscript/ParserSqlScript.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/callback/SimpleContext.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/resolver/Context.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/classpath/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/AbbreviationUtils.java

```

* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/exception/FlywayDbUpgradeRequiredException.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/snowflake/SnowflakeParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/package-
info.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sqlite/SQLiteDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/scanner/classpath/ClassPathScanner.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/IOUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/api/callback/Event.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sybasease/SybaseASESchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/StringResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/ResourceNameParser.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/output/InfoOutput.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/ClassUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/parser/PositionTracker.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/util/Pair.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/resource/filesystem/FileSystemResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/exception/FlywaySqlException.java
*
/opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerApplicationLockTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sybasease/package-info.java

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1.137 brotli 1.0.7-6ubuntu0.1

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1.138 net-snmp 5.9

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Support for streaming Protocol Buffer messages for the Go language (golang).

https://github.com/matttproud/golang_protobuf_extensions

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```
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```

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```
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```

```
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Ty Coon, President of Vice
```

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```
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##  
## -----
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```
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1.142 dav1d 0.6.0

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1.143 inja 3.1.0

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amalgamate.py - Amalgamate C source and header files
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1.144 gnulib 2019-09-23

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Files:

tests/test-update-copyright.sh

Depends-on:

configure.ac:

```
abs_aux_dir=`cd "$ac_aux_dir"; pwd`  
AC_SUBST([abs_aux_dir])
```

Makefile.am:

```
TESTS += test-update-copyright.sh  
TESTS_ENVIRONMENT += abs_aux_dir='${abs_aux_dir}'  
@c The GNU Lesser General Public License.  
@center Version 2.1, February 1999
```

```
@c This file is intended to be included within another document,  
@c hence no sectioning command or @node.
```

```
@display
```

```
Copyright @copyright{ } 1991, 1999 Free Software Foundation, Inc.  
51 Franklin Street, Fifth Floor, Boston, MA 02110-1301, USA
```

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```
@end display
```

```
@subheading Preamble
```

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Description:

Concatenate two arbitrary file names.

Files:

lib/filenamecat.h

lib/filenamecat-lgpl.c

m4/filenamecat.m4

Depends-on:

dirname-lgpl

configure.ac:

gl_FILE_NAME_CONCAT_LGPL

Makefile.am:
lib_SOURCES += filenamecat-lgpl.c

Include:
"filenamecat.h"

License:
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Maintainer:
Jim Meyering
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@heading Appendix: How to Apply These Terms to Your New Programs

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@smallexample

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and a brief idea of what it does.}

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@end smallexample

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@smallexample

Gnomovision version

69, Copyright (C) @var{year} @var{name of author}

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@end smallexample

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@example

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@var{signature of Ty Coon}, 1 April 1989

Ty Coon, President of Vice

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Files:

tests/test-canonicalize-lgpl.c

tests/signature.h

tests/null-ptr.h

tests/macros.h

Depends-on:
ignore-value
same-inode
symlink

configure.ac:

Makefile.am:

TESTS += test-canonicalize-lgpl
check_PROGRAMS += test-canonicalize-lgpl

Description:

Provide the GNU Free Documentation License in Texinfo format.

Files:

doc/fdl.texi

Depends-on:

configure.ac:

Makefile.am:

Include:

License:

unmodifiable license text

Maintainer:

all

Legal Issues about Contributing Code to GNU last updated 14 July 2015

Project GNU has to be careful to obey copyright laws, even though these laws are wrong when they stop people from sharing generally useful published information such as software, because we are in the public eye. We also use copyright to defend users' freedom, by means of copyleft (though this does not excuse copyright law for helping to make software proprietary).

This means that if you want to contribute software to GNU, you have to do something to give us legal permission to use it. There are three ways this can be done:

* Assign the copyright to the Free Software Foundation.

This allows the FSF to act to stop violations of the GPL.

* Keep the copyright and release the program yourself under the GNU

GPL. (This alternative is too impractical for contributions to a preexisting FSF-copyrighted GNU program.)

* Put the code in the public domain. Then there is nothing to stop hoarding of modified versions, but we can still use the program in GNU.

Most of these alternatives require a signed piece of paper, or in some cases a digital signature, to make it happen.

* Assigning copyright.

Assigning the copyright means signing a contract that makes the Free Software Foundation the "owner" of the program according to the law. As the copyright holder, the Foundation can sue anyone who tries to distribute the program as a proprietary product. We are willing to keep your name on the program as the author for as long as the program remains recognizably distinct. ("Owner" is in quotes to show that we don't really believe in this kind of ownership.)

The assignment contract commits the foundation to setting distribution terms that permit free redistribution.

Often we don't want to do the work of starting to distribute a program right away. There are many things which we will need in order to have a complete system but which aren't really useful until the rest of the system is done. But signing the assignment does not stop you from distributing the program yourself--as long as you do so under the GNU terms. You don't have to wait for us to start distributing. You can start distributing as soon as you attach our standard copyleft to the files. (Ask for our advice on how to do this.)

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* Public domain.

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Digital Simulation Corporation hereby disclaims all copyright interest in the program "sample.el" (a program to direct assemblers to make passes at compilers under GNU Emacs) written by Hugh Hacker.

<signature of Mo Ghoul>, 1 April 1987

Mo Ghoul, President of Vice, Digital Simulation Corp.

The description of what the program does is just to make it clearer what the disclaimer covers.

If

what you did was change an existing program, it should say this:

...in the changes and enhancements made by Hugh Hacker to the

program "sample.el".

* Did anyone else contribute?

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Please use your full legal name (in ASCII characters) as the subject line of the message.

REQUEST: SEND FORM FOR PAST AND FUTURE CHANGES

[What is the name of the program or package you're contributing to?]

[Did you copy any files or text written by someone else in these changes? Even if that material is free software, we need to know about it.]

[Do you have an employer who might have a basis to claim to own your changes? Do you attend a school which might make such a claim?]

[For the copyright registration, what country are you a citizen of?]

[What year were you born?]

[Please write your email address here.]

[Please write your postal address here.]

[Which files have you changed so far, and which new files have you written so far?]

Description:

Help make libraries relocatable, that is, to allow them to function properly when copied to an arbitrary directory.

Files:

doc/relocatable.texi

lib/relocatable.h

lib/relocatable.c

lib/relocatable.valgrind

m4/relocatable-lib.m4

Depends-on:

strdup

configure.ac:

```
gl_RELOCATABLE_LIBRARY
```

```
if test $RELOCATABLE = yes; then
```

```
  AC_LIBOBJ([relocatable])
```

```
fi
```

Makefile.am:

```
DEFS += -DNO_XMALLOC
```

Include:

```
"relocatable.h"
```

License:

GPLv2+

Maintainer:

Ben Pfaff

Description:

Ensure getcwd(NULL, 0) returns a buffer allocated by the malloc() function.

Files:

lib/getcwd-lgpl.c

m4/getcwd.m4

Depends-on:

unistd

strdup [test \$REPLACE_GETCWD = 1]

configure.ac:

```
gl_FUNC_GETCWD_LGPL
```

```
if test $REPLACE_GETCWD = 1; then
```

```
  AC_LIBOBJ([getcwd-lgpl])
```

```
fi
```

```
gl_UNISTD_MODULE_INDICATOR([getcwd])
```

Makefile.am:

Include:

<unistd.h>

License:

LGPLv2+

Maintainer:

Eric Blake

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Version 2, June 1991

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```
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```
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```

```
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(For example, a function in a library to compute square roots has

a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

That's all there is to it!

Description:

Locating a program in PATH (LGPLed version).

Files:

lib/findprog.h
lib/findprog.c
lib/findprog-lgpl.c
m4/findprog.m4
m4/eaccess.m4

Depends-on:

stdbool
strdup
concat-filename
access
unistd

configure.ac:

gl_FINDPROG
gl_MODULE_INDICATOR([findprog-lgpl])

Makefile.am:

lib_SOURCES += findprog.h findprog.c

Include:

"findprog.h"

License:

LGPLv2+

Maintainer:

all

The files in this directory describe the gnulib modules.

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so far?]

Files:

tests/test-getcwd-lgpl.c

tests/signature.h

tests/macros.h

Depends-on:

configure.ac:

Makefile.am:

TESTS += test-getcwd-lgpl

check_PROGRAMS += test-getcwd-lgpl

test_getcwd_lgpl_LDADD = \$(LDADD) \$(LIBINTL)

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Description:

realpath, canonicalize_file_name: Provide canonical absolute file name

Files:

lib/canonicalize-lgpl.c

m4/canonicalize.m4

m4/double-slash-root.m4

Depends-on:

extensions

```
stdlib
nocrash
alloca-opt [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test
$REPLACE_CANONICALIZE_FILE_NAME = 1]
errno [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test
$REPLACE_CANONICALIZE_FILE_NAME = 1]
lstat [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test $REPLACE_CANONICALIZE_FILE_NAME
= 1]
malloca [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test
$REPLACE_CANONICALIZE_FILE_NAME = 1]
memmove [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test
$REPLACE_CANONICALIZE_FILE_NAME = 1]
pathmax [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test
$REPLACE_CANONICALIZE_FILE_NAME = 1]
readlink [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test
$REPLACE_CANONICALIZE_FILE_NAME = 1]
sys_stat [test $HAVE_CANONICALIZE_FILE_NAME = 0 || test
$REPLACE_CANONICALIZE_FILE_NAME = 1]
```

configure.ac:

```
gl_CANONICALIZE_LGPL
if
test $HAVE_CANONICALIZE_FILE_NAME = 0 || test $REPLACE_CANONICALIZE_FILE_NAME = 1; then
AC_LIBOBJ([canonicalize-lgpl])
fi
gl_MODULE_INDICATOR([canonicalize-lgpl])
gl_STDLIB_MODULE_INDICATOR([canonicalize_file_name])
gl_STDLIB_MODULE_INDICATOR([realpath])
```

Makefile.am:

Include:

```
<stdlib.h>
```

License:

```
LGPLv2+
```

Maintainer:

```
all
```

Description:

```
Extract specific portions of filenames.
```

Files:

```
lib/dirname.h
```

```
lib/dirname-lgpl.c
```

```
lib/basename-lgpl.c
```

```
lib/stripslash.c
```

```
m4/dirname.m4
```

Depends-on:

dosname

double-slash-root

malloc-posix

stdbool

configure.ac:

gl_DIRNAME_LGPL

Makefile.am:

lib_SOURCES += dirname-lgpl.c basename-lgpl.c stripslashes.c

Include:

"dirname.h"

License:

LGPLv2+

Maintainer:

Jim Meyering, Eric Blake

1.145 hd-parm 9.38

1.145.1 Available under license :

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Version 2, June 1991

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<one line to give the program's name and a brief idea of what it does.>

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Also add information on how to contact you by electronic and paper mail.

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```
Gnomovision version 69, Copyright (C) year name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

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```
Yoyodyne, Inc., hereby disclaims all copyright interest in the program
`Gnomovision' (which makes passes at compilers) written by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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The only condition is that my name and copyright notice remain in the source code as-is.

Mark Lord (mlord@pobox.com)

This package was debianized by Christopher L Cheney <ccheney@debian.org> on Wed, 21 Nov 2001 15:51:14 -0600.

It was downloaded from <http://www.ibiblio.org/pub/Linux/system/hardware>

Upstream Author: Mark S. Lord <mlord@pobox.com>

Copyright:

```
/* hdparm.c - Command line interface to get/set hard disk parameters */  
/*      - by Mark Lord 1994-2008 -- freely distributable */
```

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1.146 libjpeg 8d

1.146.1 Available under license :

This is Debian's prepackaged version of the 'jpeg library' by the Independent JPEG Group.

This package was created by Mark Mickan <mmickan@debian.org> from sources which can be found at <ftp://ftp.uu.net/graphics/jpeg/jpegsrc.v6b.tar.gz>

It is partly based on the libjpeg6a package originally put together by Andy Guy <awpguy@acs.ualgary.ca> and later maintained by Mark Mickan.

Current Debian maintainer is Bill Allombert <ballombe@debian.org>.

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=====

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Foundation; principally,
that you must include source code if you redistribute it. (See the file
ansi2knr.c for full details.) However, since ansi2knr.c is not needed as part
of any program generated from the IJG code, this does not limit you more than
the foregoing paragraphs do.

The Unix configuration script "configure" was produced with GNU Autoconf.
It is copyright by the Free Software Foundation but is freely distributable.
The same holds for its supporting scripts (config.guess, config.sub,
ltmain.sh). Another support script, install-sh, is copyright by X Consortium
but is also freely distributable.

The IJG distribution formerly included code to read and write GIF files.
To avoid entanglement with the Unisys LZW patent, GIF reading support has
been removed altogether, and the GIF writer has been simplified to produce
"uncompressed GIFs". This technique does not use the LZW algorithm; the
resulting GIF files are larger than usual, but are readable by all standard
GIF decoders.

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CompuServe Incorporated."

1.147 libjpeg 9b

1.147.1 Available under license :

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```
/*  
* jddctmgr.c  
*  
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* Modified 2002-2010 by Guido Vollbeding.  
* Modifications:  
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB  
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* For conditions of distribution and use, see the accompanying README file.  
*  
* This file contains the inverse-DCT management logic.  
* This code selects a particular IDCT implementation to be used,  
* and it performs related housekeeping chores. No code in this file  
* is executed per IDCT step, only during output pass setup.  
*  
* Note that the IDCT routines are responsible for performing coefficient
```

* dequantization as well as the IDCT proper. This module sets up the
* dequantization multiplier table needed by the IDCT routine.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jddctmgr.c
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/*

* jdapistd.c

*

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*

* This file contains application interface code for the decompression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-decompression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_decompress, it will end up linking in the entire decompressor.
* We thus must separate this file from jdapimin.c to avoid linking the
* whole decompression library into a transcoder.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdapistd.c
No license file was found, but licenses were detected in source scan.

/*

* jcmaster.c

*

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* Modified 2003-2010 by Guido Vollbeding.

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*

* This file contains master control logic for the JPEG compressor.
* These routines are concerned with parameter validation, initial setup,
* and inter-pass control (determining the number of passes and the work
* to be done in each pass).

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmaster.c
No license file was found, but licenses were detected in source scan.

/*

* jsimd_i386.c

*

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* Copyright 2009-2011 D. R. Commander

*

* Based on the x86 SIMD extension for IJG JPEG library,

* Copyright (C) 1999-2006, MIYASAKA Masaru.

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*

* This file contains the interface between the "normal" portions

* of the library and the SIMD implementations when running on a

* 32-bit x86 architecture.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_i386.c
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; for more details.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2fst-64.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimxfst.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfmmxfst.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2fst.asm

*

/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2fst.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2fst-64.asm

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/*

* jsimd_none.c

*

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright 2009-2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
* This file contains stubs for when there is no SIMD support available.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimd_none.c
No license file was found, but licenses were detected in source scan.

/*

* wrtle.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

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*

* This file contains routines to write output images in RLE format.

* The Utah Raster Toolkit library is required (version 3.1 or later).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*

* Based on code contributed by Mike Lijewski,

* with updates from Robert Hutchinson.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrtle.c
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/*

* rdgif.c

*

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*

* This file contains routines to read input images in GIF format.

*

* NOTE: to avoid entanglements with Unisys' patent on LZW compression, *

* the ability to read GIF files has been removed from the IJG distribution. *
* Sorry about that. *

*
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*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdgif.c
No license file was found, but licenses were detected in source scan.

/*
* jdtrans.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
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*
* This file contains library routines for transcoding decompression,
* that is, reading raw DCT coefficient arrays from an input JPEG file.
* The routines in jdapimin.c will also be needed by a transcoder.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdtrans.c
No license file was found, but licenses were detected in source scan.

libjpeg-turbo note: This image was extracted from the 8-bit nightshot_iso_100 image. The original can be downloaded at the link below.

The New Image Compression Test Set - Jan 2008
http://www.imagecompression.info/test_images

The images historically used for compression research (lena, barbra, pepper etc...) have outlived their useful life and its about time they become a part of history only. They are too small, come from data sources too old and are available in only 8-bit precision.

These images have been carefully selected to aid in image compression algorithm research and evaluation. These are photographic images chosen to come from a wide variety of sources and each one picked to stress different aspects of algorithms. Images are available in 8-bit, 16-bit and 16-bit linear variations, RGB and gray.

Images are available without any prohibitive copyright restrictions.

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Acknowledgments: A lot of people contributed a lot of time and effort in making this test set possible. Thanks to everyone who voiced their opinion in any of the discussions online. Thanks to Axel Becker, Thomas Richter and Niels Frling for their extensive help in picking images, running all the various tests etc... Thanks to Pete Fraser, Tony Story, Wayne J. Cosshall, David Coffin, Bruce Lindbloom and raw.fotosite.pl for the images which make up this set.

Sachin Garg [India]
sachingarg@c10n.info

www.sachingarg.com | www.c10n.info | www.imagecompression.info

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/testimages/nightshot_iso_100.txt
```

No license file was found, but licenses were detected in source scan.

```
/*
```

```
* jmorecfg.h
```

```
*
```

```
* This file was part of the Independent JPEG Group's software:
```

```
* Copyright (C) 1991-1997, Thomas G. Lane.
```

```
* Modifications:
```

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```

```
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```

```
*
```

```
* This file contains additional configuration options that customize the
```

```
* JPEG software for special applications or support machine-dependent
```

```
* optimizations. Most users will not need to touch this file.
```

```
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmorecfg.h
```

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```
/*
```

* jdcOLOR.c
*
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*
* This file contains output colorspace conversion routines.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcOLOR.c
No license file was found, but licenses were detected in source scan.

/*

* wrbMP.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
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*
* This file contains routines to write output images in Microsoft "BMP"
* format (MS Windows 3.x and OS/2 1.x flavors).
* Either 8-bit colormapped or 24-bit full-color format can be written.
* No compression is supported.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*
* This code contributed by James Arthur Boucher.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrbMP.c
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Package: {__PKGNAME}
Version: {__VERSION}-{__BUILD}
Section: misc
Priority: optional
Architecture: {__ARCH}
Essential: no

Maintainer: The libjpeg-turbo Project [<http://www.libjpeg-turbo.org>]

Description: A SIMD-accelerated JPEG codec that provides both the libjpeg and TurboJPEG APIs

libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG

API. libjpeg-turbo also features colorspace extensions that allow it to compress from/decompress to 32-bit and big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/deb-control.tmp
No license file was found, but licenses were detected in source scan.

/*

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*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJLoader.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJUnitTest.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJCompressor.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJ.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg-jni.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJExample.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-
1.2.90/java/org/libjpegturbo/turbojpeg/TJDecompressor.java
No license file was found, but licenses were detected in source scan.

/*

* jdatasrc-tj.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2009-2011 by Guido Vollbeding.

* Modifications:

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*

* This file contains decompression data source routines for the case of

* reading JPEG data from memory or from a file (or any stdio stream).

* While these routines are sufficient for most applications,

- * some will want to use a different source manager.
- * IMPORTANT: we assume that fread() will correctly transcribe an array of
- * JOCTETs from 8-bit-wide elements on external storage. If char is wider
- * than 8 bits on your machine, you may need to do some tweaking.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatasrc-tj.c
No license file was found, but licenses were detected in source scan.

```
{\rtf1\ansi\ansicpg1252\cocoartf1038\cocoasubrtf350
{\fonttbl{\f0\fswiss\fcharset0 Helvetica;}
{\colortbl;\red255\green255\blue255;}
{*\listtable{\list\listtemplateid1\listhybrid{\listlevel\levelnfc23\levelnfc23\leveljcn0\leveljcn0\levelfollow0\levelstartat1\levelspace360\levelindent0{*\levelmarker \{ disc \}}{\leveltext\leveltemplateid1\01\uc0\u8226
;}{\levelnumbers;}\fi-360\li720\lin720 }{\listname ;}\listid1 }}
{*\listoverrideable{\listoverride\listid1\listoverridecount0\ls1 }}
\margl1440\margr1440\vieww9820\viewh8480\viewkind0
\defstab720
\pard\pardefstab720
```

\f0\fs24 \cf0 Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:\

```
\
\pard\tx220\tx720\pardefstab720\li720\fi-720
\ls1\ilvl0\cf0 {\listtext \95 }Redistributions of source code must retain the above copyright notice, this list of
conditions and the following disclaimer.\
{\listtext \95 }Redistributions
in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the
documentation and/or other materials provided with the distribution.\
{\listtext \95 }Neither the name of the libjpeg-turbo Project nor the names of its contributors may be used to endorse
or promote products derived from this software without specific prior written permission.\
\pard\pardefstab720\qc
\cf0 \
\pard\pardefstab720
```

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Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/License.rtf
No license file was found, but licenses were detected in source scan.

/*

* jdcoefct.c

*

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*

* This file contains the coefficient buffer controller for decompression.

* This controller is the top level of the JPEG decompressor proper.

* The coefficient buffer lies between entropy decoding and inverse-DCT steps.

*

* In buffered-image mode, this controller is the interface between

* input-oriented processing and output-oriented processing.

* Also, the input side (only) is used when reading a file for transcoding.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcoefct.c
No license file was found, but licenses were detected in source scan.

/*

* jcinit.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

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* For conditions of distribution and use, see the accompanying README file.

*

* This file contains initialization logic for the JPEG compressor.

* This routine is in charge of selecting the modules to be executed and

* making an initialization call to each one.

*

* Logically, this code belongs in jcmaster.c. It's split out because

* linking this routine implies linking the entire compression library.

* For a transcoding-only application, we want to be able to use jcmaster.c

* without linking in the whole library.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcinit.c

No license file was found, but licenses were detected in source scan.

** Background

libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG API. libjpeg-turbo also features colorspace extensions that allow it to compress from/decompress to 32-bit and big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.

** License

Most of libjpeg-turbo inherits the non-restrictive, BSD-style license used by libjpeg (see README.) The TurboJPEG wrapper (both C and Java versions) and associated test programs bear a similar license, which is reproduced below:

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```
*****  
** Using libjpeg-turbo  
*****
```

libjpeg-turbo includes two APIs that can be used to compress and decompress JPEG images:

TurboJPEG API: This API provides an easy-to-use interface for compressing and decompressing JPEG images in memory. It also provides some functionality that would not be straightforward to achieve using the underlying libjpeg API, such as generating planar YUV images and performing multiple simultaneous lossless transforms on an image. The Java interface for libjpeg-turbo is written on top of the TurboJPEG API.

libjpeg API: This is the de facto industry-standard API for compressing and decompressing JPEG images. It is more difficult to use than the TurboJPEG API but also more powerful. The libjpeg API implementation in libjpeg-turbo is both API/ABI-compatible and mathematically compatible with libjpeg v6b. It can also optionally be configured to be API/ABI-compatible with libjpeg v7 and v8 (see below.)

There is no significant performance advantage to either API when both are used to perform similar operations.

```
=====  
Installation Directory  
=====
```

This document assumes that libjpeg-turbo will be installed in the default directory (/opt/libjpeg-turbo on Un*x and Mac systems and c:\libjpeg-turbo[-gcc][64] on Windows systems. If your installation of

libjpeg-turbo resides in a different directory, then adjust the instructions accordingly.

```
=====
Replacing libjpeg
at Run Time
=====
```

Un*x

If a Un*x application is dynamically linked with libjpeg, then you can replace libjpeg with libjpeg-turbo at run time by manipulating LD_LIBRARY_PATH. For instance:

[Using libjpeg]

```
> time cjpeg <vgl_5674_0098.ppm >vgl_5674_0098.jpg
real 0m0.392s
user 0m0.074s
sys 0m0.020s
```

[Using libjpeg-turbo]

```
> export LD_LIBRARY_PATH=/opt/libjpeg-turbo/{lib}:$LD_LIBRARY_PATH
> time cjpeg <vgl_5674_0098.ppm >vgl_5674_0098.jpg
real 0m0.109s
user 0m0.029s
sys 0m0.010s
```

({lib} = lib32 or lib64, depending on whether you wish to use the 32-bit or the 64-bit version of libjpeg-turbo.)

System administrators can also replace the libjpeg symlinks in /usr/lib* with links to the libjpeg-turbo dynamic library located in /opt/libjpeg-turbo/{lib}. This will effectively accelerate every application that uses the libjpeg dynamic library on the system.

Windows

If a Windows application is dynamically linked with libjpeg, then you can replace libjpeg with libjpeg-turbo at run time by backing up the application's copy of jpeg62.dll, jpeg7.dll, or jpeg8.dll (assuming the application has its own local copy of this library) and copying the corresponding DLL from libjpeg-turbo into the application's install directory. The official libjpeg-turbo binary packages only provide jpeg62.dll. If the application uses jpeg7.dll or jpeg8.dll instead, then it will be necessary to build libjpeg-turbo from source (see "libjpeg v7 and v8 API/ABI Emulation" below.)

The following information is specific to the official libjpeg-turbo binary packages for Visual C++:

-- jpeg62.dll requires the Visual C++ 2008 C run-time DLL (msvcr90.dll). msvcr90.dll ships with more recent versions of Windows, but users of older Windows releases can obtain it from the Visual C++ 2008 Redistributable Package, which is available as a free download from Microsoft's web site.

-- Features of the libjpeg API that require passing a C run-time structure, such as a file handle, from an application to the library will probably not work with jpeg62.dll, unless the application is also built to use the Visual C++ 2008 C run-time DLL. In particular, this affects jpeg_stdio_dest() and jpeg_stdio_src().

Mac

Mac applications typically embed their own copies of the libjpeg dylib inside the (hidden) application bundle, so it is not possible to globally replace libjpeg on OS X systems. Replacing the application's version of the libjpeg dylib would generally involve copying libjpeg.*.dylib from libjpeg-turbo into the appropriate place in the application bundle and using install_name_tool to repoint the libjpeg-turbo dylib to its new directory. This requires an advanced knowledge of OS X and would not survive an upgrade or a re-install of the application. Thus, it is not recommended for most users.

=====
Using libjpeg-turbo in Your Own Programs
=====

For the most part, libjpeg-turbo should work identically to libjpeg, so in most cases, an application can be built against libjpeg and then run against libjpeg-turbo. On Un*x systems and Cygwin, you can build against libjpeg-turbo instead of libjpeg by setting

```
CPATH=/opt/libjpeg-turbo/include  
and  
LIBRARY_PATH=/opt/libjpeg-turbo/{lib}
```

({lib} = lib32 or lib64, depending on whether you are building a 32-bit or a 64-bit application.)

If using MinGW, then set

```
CPATH=/c/libjpeg-turbo-gcc[64]/include
```

and

```
LIBRARY_PATH=/c/libjpeg-turbo-gcc[64]/lib
```

Building against libjpeg-turbo is useful, for instance, if you want to build an application that leverages the libjpeg-turbo colorspace extensions (see below.) On Un*x systems, you would still need to manipulate LD_LIBRARY_PATH or create appropriate symlinks to use libjpeg-turbo at run time. On such systems, you can pass `-R /opt/libjpeg-turbo/{lib}` to the linker to force the use of libjpeg-turbo at run time rather than libjpeg (also useful if you want to leverage the colorspace extensions), or you can link against the libjpeg-turbo static library.

To force a Un*x or MinGW application to link against the static version of libjpeg-turbo, you can use the following linker options:

```
-Wl,-Bstatic -ljpeg -Wl,-Bdynamic
```

On OS X, simply add `/opt/libjpeg-turbo/lib/libjpeg.a` to the linker command line.

To build Visual C++ applications using libjpeg-turbo, add `c:\libjpeg-turbo[64]\include` to the system or user INCLUDE environment variable and `c:\libjpeg-turbo[64]\lib` to the system or user LIB environment variable, and then link against either `jpeg.lib` (to use the DLL version of libjpeg-turbo) or `jpeg-static.lib` (to use the static version of libjpeg-turbo.)

```
=====  
Colorspace Extensions  
=====
```

libjpeg-turbo includes extensions that allow JPEG images to be compressed directly from (and decompressed directly to) buffers that use BGR, BGRX, RGBX, XBGR, and XRGB pixel ordering. This is implemented with ten new colorspace constants:

```
JCS_EXT_RGB /* red/green/blue */  
JCS_EXT_RGBX /* red/green/blue/x */  
JCS_EXT_BGR /* blue/green/red */  
JCS_EXT_BGRX /* blue/green/red/x */  
JCS_EXT_XBGR /* x/blue/green/red */  
JCS_EXT_XRGB /* x/red/green/blue */  
JCS_EXT_RGBA /* red/green/blue/alpha */  
JCS_EXT_BGRA /* blue/green/red/alpha */  
JCS_EXT_ABGR /* alpha/blue/green/red */  
JCS_EXT_ARGB /* alpha/red/green/blue */
```


Setting `cinfo.in_color_space` (compression) or `cinfo.out_color_space` (decompression) to one of these values will cause libjpeg-turbo to read the red, green, and blue values from (or write them to) the appropriate position in the pixel when compressing from/decompressing to an RGB buffer.

Your application can check for the existence of these extensions at compile time with:

```
#ifdef JCS_EXTENSIONS
```

At run time, attempting to use these extensions with a libjpeg implementation that does not support them will result in a "Bogus input colorspace" error.

Applications

can trap this error in order to test whether run-time support is available for the colorspace extensions.

When using the RGBX, BGRX, XBGR, and XRGB colorspace during decompression, the X byte is undefined, and in order to ensure the best performance, libjpeg-turbo can set that byte to whatever value it wishes. If an application expects the X byte to be used as an alpha channel, then it should specify `JCS_EXT_RGBA`, `JCS_EXT_BGRA`, `JCS_EXT_ABGR`, or `JCS_EXT_ARGB`. When these colorspace constants are used, the X byte is guaranteed to be `0xFF`, which is interpreted as opaque.

Your application can check for the existence of the alpha channel colorspace extensions at compile time with:

```
#ifdef JCS_ALPHA_EXTENSIONS
```

`jcstest.c`, located in the libjpeg-turbo source tree, demonstrates how to check for the existence of the colorspace extensions at compile time and run time.

```
=====  
libjpeg v7 and v8 API/ABI Emulation  
=====
```

With libjpeg

v7 and v8, new features were added that necessitated extending the compression and decompression structures. Unfortunately, due to the exposed nature of those structures, extending them also necessitated breaking backward ABI compatibility with previous libjpeg releases. Thus, programs that were built to use libjpeg v7 or v8 did not work with libjpeg-turbo, since it is based on the libjpeg v6b code base. Although libjpeg v7 and v8 are still not as widely used as v6b, enough programs (including a few Linux distros) made the switch that there was a demand to emulate the libjpeg v7 and v8 ABIs in libjpeg-turbo. It should be noted, however, that this feature was added primarily so that applications that had already been compiled to use libjpeg v7+ could take advantage of accelerated baseline JPEG encoding/decoding without recompiling. libjpeg-turbo does not claim to support all of the

libjpeg v7+ features, nor to produce identical output to libjpeg v7+ in all cases (see below.)

By

passing an argument of `--with-jpeg7` or `--with-jpeg8` to `configure`, or an argument of `-DWITH_JPEG7=1` or `-DWITH_JPEG8=1` to `cmake`, you can build a version of `libjpeg-turbo` that emulates the `libjpeg v7` or `v8` ABI, so that programs that are built against `libjpeg v7` or `v8` can be run with `libjpeg-turbo`. The following section describes which `libjpeg v7+` features are supported and which aren't.

Support for `libjpeg v7` and `v8` Features:

Fully supported:

- `libjpeg`: IDCT scaling extensions in decompressor
`libjpeg-turbo` supports IDCT scaling with scaling factors of 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 9/8, 5/4, 11/8, 3/2, 13/8, 7/4, 15/8, and 2/1 (only 1/4 and 1/2 are SIMD-accelerated.)
- `libjpeg`: arithmetic coding
- `libjpeg`: In-memory source and destination managers
See notes below.
- `cjpeg`: Separate quality settings for luminance and chrominance
Note that the `libjpeg v7+` API was extended to accommodate this feature only for convenience purposes. It has always been possible to implement this feature with `libjpeg v6b` (see `rdswitch.c` for an example.)
- `cjpeg`: 32-bit BMP support
- `cjpeg`: `-rgb` option
- `jpegtran`: lossless cropping
- `jpegtran`: `-perfect` option
- `jpegtran`: forcing width/height when performing lossless crop
- `rdjpgcom`: `-raw` option
- `rdjpgcom`: locale awareness

Not supported:

NOTE: As of this writing, extensive research has been conducted into the usefulness of DCT scaling as a means of data reduction and SmartScale as a means of quality improvement. The reader is invited to peruse the research at <http://www.libjpeg-turbo.org/About/SmartScale> and draw his/her own conclusions, but it is the general belief of our project that these features have not demonstrated sufficient usefulness to justify inclusion in libjpeg-turbo.

-- libjpeg: DCT scaling in compressor

`cinfo.scale_num` and `cinfo.scale_denom` are silently ignored.

There is no technical reason why DCT scaling could not be supported when

emulating the libjpeg v7+ API/ABI, but without the SmartScale extension (see below), only scaling factors of 1/2, 8/15, 4/7, 8/13, 2/3, 8/11, 4/5, and 8/9 would be available, which is of limited usefulness.

-- libjpeg: SmartScale

`cinfo.block_size` is silently ignored.

SmartScale is an extension to the JPEG format that allows for DCT block sizes other than 8x8. Providing support for this new format would be feasible (particularly without full acceleration.) However, until/unless the format becomes either an official industry standard or, at minimum, an accepted solution in the community, we are hesitant to implement it, as there is no sense of whether or how it might change in the future. It is our belief that SmartScale has not demonstrated sufficient usefulness as a lossless format nor as a means of quality enhancement, and thus, our primary interest in providing this feature would be as a means of supporting additional DCT scaling factors.

-- libjpeg: Fancy downsampling in compressor

`cinfo.do_fancy_downsampling` is silently ignored.

This requires the DCT scaling feature, which is not supported.

-- jpegtran: Scaling

This requires both the DCT scaling and SmartScale features, which are not supported.

-- Lossless RGB JPEG files

This requires the SmartScale feature, which is not supported.

What About libjpeg v9?

libjpeg v9 introduced yet another field to the JPEG compression structure (`color_transform`), thus making the ABI backward incompatible with that of libjpeg v8. This new field was introduced solely for the purpose of supporting lossless SmartScale encoding. Further, there was actually no reason to extend

the API in this manner, as the color transform could have just as easily been activated by way of a new JPEG colorspace constant, thus preserving backward ABI compatibility.

Our research (see link above) has shown that lossless SmartScale does not generally accomplish anything that can't already be accomplished better with existing, standard lossless formats. Thus, at this time, it is our belief that there is not sufficient technical justification for software to upgrade from libjpeg v8 to libjpeg v9, and therefore, not sufficient technical justification for us to emulate the libjpeg v9 ABI.

=====
In-Memory Source/Destination Managers
=====

By default, libjpeg-turbo 1.3 and later includes the `jpeg_mem_src()` and `jpeg_mem_dest()` functions, even when not emulating the libjpeg v8 API/ABI. Previously, it was necessary to build libjpeg-turbo from source with libjpeg v8 API/ABI emulation in order to use the in-memory source/destination managers, but several projects requested that those functions be included when emulating the libjpeg v6b API/ABI as well. This allows the use of those functions by programs that need them without breaking ABI compatibility for programs that don't, and it allows those functions to be provided in the "official" libjpeg-turbo binaries.

Those who are concerned about maintaining strict conformance with the libjpeg v6b or v7 API can pass an argument of `--without-mem-srcdst` to configure or an argument of `-DWITH_MEM_SRCDEST=0` to CMake prior to building libjpeg-turbo. This will restore the pre-1.3 behavior, in which `jpeg_mem_src()` and `jpeg_mem_dest()` are only included when emulating the libjpeg v8 API/ABI.

On Un*x systems, including the in-memory source/destination managers changes the dynamic library version from 62.0.0 to 62.1.0 if using libjpeg v6b API/ABI emulation and from 7.0.0 to 7.1.0 if using libjpeg v7 API/ABI emulation.

Note that, on most Un*x systems, the dynamic linker will not look for a function in a library until that function is actually used. Thus, if a program is built against libjpeg-turbo 1.3+ and uses `jpeg_mem_src()` or `jpeg_mem_dest()`, that program will not fail if run against an older version of libjpeg-turbo or against libjpeg v7- until the program actually tries to call `jpeg_mem_src()` or `jpeg_mem_dest()`. Such is not the case on Windows. If a program is built against the libjpeg-turbo 1.3+ DLL and uses `jpeg_mem_src()` or `jpeg_mem_dest()`, then it must use the libjpeg-turbo 1.3+ DLL at run time.

Both `cjpeg` and `djpeg` have been extended to allow testing the in-memory

source/destination manager functions. See their respective man pages for more details.

```
*****  
**  Mathematical Compatibility  
*****
```

For the most part, libjpeg-turbo should produce identical output to libjpeg v6b. The one exception to this is when using the floating point DCT/IDCT, in which case the outputs of libjpeg v6b and libjpeg-turbo are not guaranteed to be identical (the accuracy of the floating point DCT/IDCT is constant when using libjpeg-turbo's SIMD extensions, but otherwise, it can depend heavily on the compiler and compiler settings.)

While libjpeg-turbo does emulate the libjpeg v8 API/ABI, under the hood, it is still using the same algorithms as libjpeg v6b, so there are several specific cases in which libjpeg-turbo cannot be expected to produce the same output as libjpeg v8:

- When decompressing using scaling factors of 1/2 and 1/4, because libjpeg v8 implements those scaling algorithms a bit differently than libjpeg v6b does, and libjpeg-turbo's SIMD extensions are based on the libjpeg v6b behavior.
- When using chrominance subsampling, because libjpeg v8 implements this with its DCT/IDCT scaling algorithms rather than with a separate downsampling/upsampling algorithm.
- When using the floating point IDCT, for the reasons stated above and also because the floating point IDCT algorithm was modified in libjpeg v8a to improve accuracy.
- When decompressing using a scaling factor > 1 and merged (AKA "non-fancy" or "non-smooth") chrominance upsampling, because libjpeg v8 does not support merged upsampling with scaling factors > 1.

```
*****  
**  Performance Pitfalls  
*****
```

```
=====  
Restart Markers  
=====
```

The optimized Huffman decoder in libjpeg-turbo does not handle restart markers

in a way that makes the rest of the libjpeg infrastructure happy, so it is necessary to use the slow Huffman decoder when decompressing a JPEG image that has restart markers. This can cause the decompression performance to drop by as much as 20%, but the performance will still be much greater than that of libjpeg. Many consumer packages, such as PhotoShop, use restart markers when generating JPEG images, so images generated by those programs will experience this issue.

=====
Fast Integer Forward DCT at High Quality Levels
=====

The algorithm used by the SIMD-accelerated quantization function cannot produce correct results whenever the fast integer forward DCT is used along with a JPEG quality of 98-100. Thus, libjpeg-turbo must use the non-SIMD quantization function in those cases. This causes performance to drop by as much as 40%. It is therefore strongly advised that you use the slow integer forward DCT whenever encoding images with a JPEG quality of 98 or higher.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/README-turbo.txt
No license file was found, but licenses were detected in source scan.

```
/*  
* jsimddct.h  
*  
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB  
*  
* Based on the x86 SIMD extension for IJG JPEG library,  
* Copyright (C) 1999-2006, MIYASAKA Masaru.  
* For conditions of distribution and use, see copyright notice in jsimdext.inc  
*  
*/
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimddct.h
No license file was found, but licenses were detected in source scan.

```
# Copyright (C)2009-2011 D. R. Commander. All Rights Reserved.  
#  
# Redistribution and use in source and binary forms, with or without  
# modification, are permitted provided that the following conditions are met:  
#  
# - Redistributions of source code must retain the above copyright notice,  
# this list of conditions and the following disclaimer.
```

```
# - Redistributions in binary form must reproduce the above copyright notice,
# this list of conditions and the following disclaimer in the documentation
# and/or other materials provided with the distribution.
# - Neither the name of the libjpeg-turbo Project nor the names of its
# contributors may be used to endorse or promote products derived from this
# software without specific prior written permission.
#
# THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS",
# AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE
# IMPLIED
# WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
# ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR CONTRIBUTORS BE
# LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
# CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
# SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
# INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
# CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
# ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
# POSSIBILITY OF SUCH DAMAGE.
```

```
#!/bin/sh
```

```
if [ ! "`id -u`" = "0" ]; then
    echo "ERROR: This script must be executed as root"
    exit -1
fi
```

```
PACKAGE=@PACKAGE_NAME@
MACPACKAGE=com.$PACKAGE.$PACKAGE
RECEIPT=/Library/Receipts/$PACKAGE.pkg
```

```
LSBOM=
if [ -d $RECEIPT ]; then
    LSBOM='lsbom -s -f -l '$RECEIPT'/Contents/Archive.bom'
else
    LSBOM='pkgutil --files '$MACPACKAGE
fi
```

```
mylsbom()
{
    $LSBOM || (echo "ERROR: Could
not list package contents"; exit -1)
}
```

```
echo Removing package files ...
EXITSTATUS=0
pushd /
mylsbom | while read file; do
```

```

if [ ! -d "$file" ]; then rm "$file" 2>&1 || EXITSTATUS=-1; fi
done
popd

echo Removing package directories ...
if [ -d /opt/$PACKAGE/bin ]; then
  rmdir /opt/$PACKAGE/bin 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/lib ]; then
  rmdir /opt/$PACKAGE/lib 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/include ]; then
  rmdir /opt/$PACKAGE/include 2>&1 || EXITSTATUS=-1
fi
rm /opt/$PACKAGE/lib32 2>&1 || EXITSTATUS=-1
rm /opt/$PACKAGE/lib64 2>&1 || EXITSTATUS=-1
if [ -d /opt/$PACKAGE/man/man1 ]; then
  rmdir /opt/$PACKAGE/man/man1 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/man ]; then
  rmdir /opt/$PACKAGE/man 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/classes ]; then
  rmdir /opt/$PACKAGE/classes 2>&1 || EXITSTATUS=-1
fi
rmdir /opt/$PACKAGE 2>&1 || EXITSTATUS=-1
rmdir /Library/Documentation/$PACKAGE 2>&1 || EXITSTATUS=-1

if [ -d $RECEIPT ]; then
  echo Removing
  package receipt ...
  rm -r $RECEIPT 2>&1 || EXITSTATUS=-1
else
  echo Forgetting package $MACPACKAGE ...
  pkgutil --forget $MACPACKAGE
fi

exit $EXITSTATUS

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/uninstall.in
No license file was found, but licenses were detected in source scan.

```

/*

* jdapimin.c

*

* Copyright (C) 1994-1998, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the decompression half
* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-decompression case or the
* transcoding-only case.
*
* Most of the routines intended to be called directly by an application
* are in this file or in jdapistd.c. But also see jcomapi.c for routines
* shared by compression and decompression, and jdtrans.c for the transcoding
* case.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdapimin.c
No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

Copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding.

This file was part of the Independent JPEG Group's software.

It was modified by The libjpeg-turbo Project to include only information relevant to libjpeg-turbo.

For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software; that is, the functions of the various modules in the system and the interfaces between modules. For more precise details about any data structure or calling convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard.

The README file includes references for learning about JPEG. The file libjpeg.txt describes the library from the viewpoint of an application programmer using the library; it's best to read that file before this one.

Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific terminology follows the JPEG standard:

A "component" means a color channel, e.g., Red or Luminance.

A "sample" is a single component value (i.e., one number in the image data).

A "coefficient" is a frequency coefficient (a DCT transform output number).

A "block" is an 8x8 group of samples or coefficients.

An "MCU" (minimum coded unit) is an interleaved set of blocks of size determined by the sampling factors, or a single block in a noninterleaved scan.

We do not use the terms "pixel" and "sample" interchangeably. When we say pixel, we mean an element of the full-size image, while a sample is an element of the downsampled image. Thus the number of samples may vary across components while the number of pixels does not. (This terminology is not used rigorously throughout the code, but it is used in places where confusion would otherwise result.)

*** System features

The IJG distribution contains two parts:

- * A subroutine library for JPEG compression and decompression.
- * cjpeg/djpeg, two sample applications that use the library to transform JFIF JPEG files to and from several other image formats.

cjpeg/djpeg are of no great intellectual complexity: they merely add a simple command-line user interface and I/O routines for several uncompressed image formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended sequential, and progressive DCT processes. Hierarchical processes are not supported.

The library does not support the lossless (spatial) JPEG process. Lossless JPEG shares little or no code with lossy JPEG, and would normally be used without the extensive pre- and post-processing provided by this library. We feel that lossless JPEG is better handled by a separate library.

Within these limits, any set of compression parameters allowed by the JPEG spec

should be readable for decompression. (We can be more restrictive about what formats we can generate.) Although the system design allows for all parameter values, some uncommon settings are not yet implemented and may never be; nonintegral sampling ratios are the prime example. Furthermore, we treat 8-bit vs. 12-bit data precision as a compile-time switch, not a run-time option, because most machines can store 8-bit pixels much more compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, libtiff uses this library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess

the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

*** Portability issues ***

Portability is an essential requirement for the library. The key portability issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run on PC-class machines with limited memory. Images should therefore be processed sequentially (in strips), to avoid holding the whole image in memory at once. Where a full-image buffer is necessary, we should be able to use either virtual memory or temporary files.
2. Near/far pointer distinction. To run efficiently on 80x86 machines, the code should distinguish "small" objects (kept in near data space) from "large" ones (kept in far data space). This is an annoying restriction, but fortunately it does not impact code quality for less brain-damaged machines, and the source code clutter turns out to be minimal with sufficient use of pointer typedefs.
3. Data precision. We assume that "char" is at least 8 bits, "short" and "int" at least 16, "long" at least 32. The code will work fine with larger data sizes, although memory may be used inefficiently in some cases. However, the JPEG compressed datastream must ultimately appear on external storage as a sequence of 8-bit bytes if it is to conform to the standard. This may pose a problem on machines where char is wider than 8 bits. The library represents compressed data as an array of values of typedef JOCTET. If no data type exactly 8 bits wide is available, custom data source and data destination modules must be written to unpack and pack the chosen JOCTET datatype into 8-bit external representation.

*** System overview ***

The compressor and decompressor are each divided into two main sections: the JPEG compressor or decompressor proper, and the preprocessing or postprocessing functions. The interface between these two sections is the image data that the official JPEG spec regards as its input or output: this data is in the colorspace to be used for compression, and it is downsampled to the sampling factors to be used. The preprocessing and postprocessing steps are responsible for converting a normal image representation to or from this form. (Those few applications that want to deal with YCbCr downsampled data can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main elements:

Preprocessing:

- * Color space conversion (e.g., RGB to YCbCr).
- * Edge expansion and downsampling. Optionally, this step can do simple smoothing --- this is often helpful for low-quality source data.

JPEG proper:

- * MCU assembly, DCT, quantization.
- * Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation, and support code (memory management & error handling). There is also a module responsible for physically writing the output data --- typically this is just an interface to `fwrite()`, but some applications may need to do something else with the data.

The decompressor library contains the following main elements:

JPEG proper:

- * Entropy decoding (sequential or progressive, Huffman or arithmetic).
- * Dequantization, inverse DCT,

MCU disassembly.

Postprocessing:

- * Upsampling. Optionally, this step may be able to do more general rescaling of the image.
- * Color space conversion (e.g., YCbCr to RGB). This step may also provide gamma adjustment [currently it does not].
- * Optional color quantization (e.g., reduction to 256 colors).
- * Optional color precision reduction (e.g., 24-bit to 15-bit color).
[This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module. The support code (memory management & error handling) can be shared with the compression half of the library.

There may be several implementations of each of these elements, particularly

in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries) as a preprocessing/postprocessing function, even though the JPEG spec includes it in compression/decompression. We do this because downsampling/upsampling can be simplified a little if they work on padded data: it's not necessary to have special cases at the right and bottom edges. Therefore the interface buffer is always an integral number of blocks wide and high, and we expect compression preprocessing to pad the source data properly. Padding will occur only to the next block (8-sample) boundary. In an interleaved-scan situation, additional dummy blocks may be used to fill out MCUs, but the MCU assembly and disassembly logic will create or discard these blocks internally. (This is advantageous for speed reasons, since we avoid DCTing the dummy blocks. It also permits a small reduction in file size, because the compressor can choose dummy block contents so as to minimize their size in compressed form. Finally, it makes the interface buffer specification independent of whether the file is actually interleaved or not.) Applications that wish to deal directly with the downsampled data must provide similar buffering and padding for odd-sized images.

*** Poor man's object-oriented programming ***

It should be clear by now that we have a lot of quasi-independent processing steps, many of which have several possible behaviors. To avoid cluttering the code with lots of switch statements, we use a simple form of object-style programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented as two separate modules that present the same external interface; at runtime, the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while staying within portable C.

The basic tool is a function pointer. An "object" is just a struct containing one or more function pointer fields, each of which corresponds to a method name in real object-oriented languages. During initialization we fill in the function pointers with references to whichever module we have determined we need to use in this run. Then invocation of the module is done by indirecting through a function pointer; on most machines this is no more

expensive than a switch statement, which would be the only other way of making the required run-time choice. The really significant benefit, of course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different implementations of the same kind of object. We do this by making all the module-specific object structs be separately allocated entities, which will be accessed via pointers in the master compression or decompression struct.

The "public"

fields or methods for a given kind of object are specified by a commonly known struct. But a module's initialization code can allocate a larger struct that contains the common struct as its first member, plus additional private fields. With appropriate pointer casting, the module's internal functions can access these private fields. (For a simple example, see `jdatadst.c`, which implements the external interface specified by struct `jpeg_destination_mgr`, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple versions of any method, each tuned to a particular case. While a lot of precalculation might be done to select an optimal implementation of a method, the cost per invocation is constant. For example, the upsampling step might have a "generic" method, plus one or more "hardwired" methods for the most popular

sampling factors; the hardwired methods would be faster because they'd use straight-line code instead of for-loops. The cost to determine which method to use is paid only once, at startup, and the selection criteria are hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures, in that only one instance of each object class will exist during execution. The reason for having the class structure is that on different runs we may create different instances (choose to execute different modules). You can think of the term "method" as denoting the common interface presented by a particular set of interchangeable functions, and "object" as denoting a group of related methods, or the total shared interface behavior of a group of modules.

*** Overall control structure ***

We previously mentioned the need for overall control logic in the compression and decompression libraries. In IJG implementations prior to v5, overall control was

mostly provided by "pipeline control" modules, which proved to be large, unwieldy, and hard to understand. To improve the situation, the control logic has been subdivided into multiple modules. The control modules

consist of:

1. Master control for module selection and initialization. This has two responsibilities:

1A. Startup initialization at the beginning of image processing.

The individual processing modules to be used in this run are selected and given initialization calls.

1B. Per-pass control. This determines how many passes will be performed and calls each active processing module to configure itself

appropriately at the beginning of each pass. End-of-pass processing, where necessary, is also invoked from the master control module.

Method selection is partially distributed, in that a particular processing module may contain several possible implementations of a particular method, which it will select among when given

its initialization call. The master

control code need only be concerned with decisions that affect more than one module.

2. Data buffering control. A separate control module exists for each inter-processing-step data buffer. This module is responsible for invoking the processing steps that write or read that data buffer.

Each buffer controller sees the world as follows:

```
input data => processing step A => buffer => processing step B => output data
          |           |           |
          ----- controller -----
```

The controller knows the dataflow requirements of steps A and B: how much data they want to accept in one chunk and how much they output in one chunk. Its function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a higher-level control module; thus the control modules form a binary tree with elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can be had by replacing implementations of a control module. For example:

* Merging of adjacent steps in the pipeline is done by replacing a control module and its pair of processing-step modules with a single processing-step module. (Hence the possible merges are determined by the tree of control modules.)

* In some processing modes, a given interstep buffer need only be a "strip" buffer large enough to accommodate the desired data chunk sizes. In other

modes, a full-image buffer is needed and several passes are required. The control module determines which kind of buffer is used and manipulates virtual array buffers as needed. One or both processing steps may be unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers interchangeable and provide just one set of implementations for all. In practice, each one contains considerable special-case processing for its particular job. The buffer controller concept should be regarded as an overall system structuring principle, not as a complete description of the task performed by any one controller.

*** Compression object structure ***

Here is a sketch of the logical structure of the JPEG compression library:

```

                                |-- Colospace conversion
        |-- Preprocessing controller --|
        |                               |-- Downsampling
Main controller --|
        |                               |-- Forward DCT, quantize
        |-- Coefficient controller --|
        |                               |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during typical image data processing. Each of the components shown in the diagram is an "object" which may have several different implementations available. One or more source code files contain the actual implementation(s) of each object.

The objects shown above are:

* Main controller: buffer controller for the subsampled-data buffer, which holds the preprocessed input data. This controller invokes preprocessing to fill the subsampled-data buffer, and JPEG compression to empty it. There is usually no need for a full-image buffer here; a strip buffer is adequate.

* Preprocessing controller: buffer controller for the downsampling input data buffer, which lies between colospace conversion and downsampling. Note that a unified conversion/downsampling module would probably replace this controller entirely.

* Colospace conversion: converts application image data into the desired JPEG color space; also changes the data from pixel-interleaved layout to separate component planes. Processes one pixel row at a time.

* Downsampling: performs reduction of chroma components as required. Optionally may perform pixel-level smoothing as well. Processes a "row group" at a time, where a row group is defined as V_{max} pixel rows of each component before downsampling, and V_k sample rows afterwards (remember V_k differs across components). Some downsampling or smoothing algorithms may require context rows above and below the current row group; the preprocessing controller is responsible for supplying these rows via proper buffering. The downsampler is responsible for edge expansion at the right edge (i.e., extending each sample row to a multiple of 8 samples); but the preprocessing controller is responsible for vertical edge expansion (i.e., duplicating the bottom sample row as needed to make a multiple of 8 rows).

* Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU assembly, including insertion of dummy DCT blocks when needed at the right or bottom edge. When performing Huffman-code optimization or emitting a multiscan JPEG file, this controller is responsible for buffering the full image. The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the JPEG file is noninterleaved.

* Forward DCT and quantization: Perform DCT, quantize, and emit coefficients. Works on one or more DCT blocks at a time. (Note: the coefficients are now emitted in normal array order, which the entropy encoder is expected to convert to zigzag order as necessary. Prior versions of the IJG code did the conversion to zigzag order within the quantization step.)

* Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the coded data to the data destination module. Works on one MCU per call. For progressive JPEG, the same DCT blocks are fed to the entropy coder during each pass, and the coder must emit the appropriate subset of coefficients.

In addition to the above objects, the compression library includes these objects:

* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules.

* Marker writing: generates JPEG markers (except for RSTn, which is emitted by the entropy encoder when needed).

* Data destination manager: writes the output JPEG datastream to its final destination (e.g., a file). The destination manager supplied with the library knows how to write to a stdio stream or to a memory buffer; for other behaviors, the surrounding application may provide its own

destination manager.

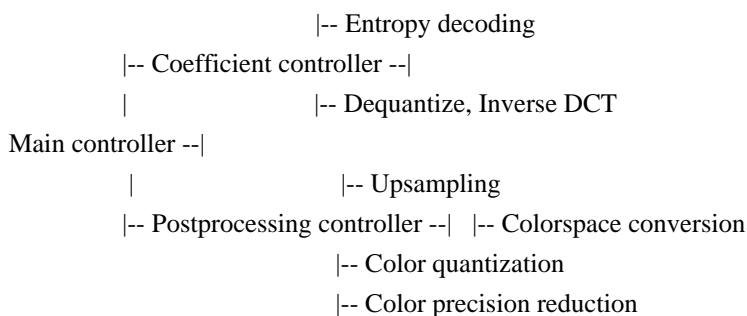
- * Memory manager: allocates and releases memory, controls virtual arrays (with backing store management, where required).
- * Error handler: performs formatting and output of error and trace messages; determines handling of nonfatal errors. The surrounding application may override some or all of this object's methods to change error handling.
- * Progress monitor: supports output of "percent-done" progress reports. This object represents an optional callback to the surrounding application: if wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are defined as separate objects in order to simplify application-specific customization of the JPEG library. A surrounding application may override individual methods or supply its own all-new implementation of one of these objects. The object interfaces for these objects are therefore treated as part of the application interface of the library, whereas the other objects are internal to the library.

The error handler and memory manager are shared by JPEG compression and decompression; the progress monitor, if used, may be shared as well.

*** Decompression object structure ***

Here is a sketch of the logical structure of the JPEG decompression library:



As before, this diagram also represents typical control flow. The objects shown are:

- * Main controller: buffer controller for the subsampled-data buffer, which holds the output of JPEG decompression proper. This controller's primary task is to feed the postprocessing procedure. Some upsampling algorithms may require context rows above and below the current row group; when this is true, the main controller is responsible for managing its buffer so as to make context rows available. In the current design, the main buffer is

always a strip buffer; a full-image buffer is never required.

* Coefficient controller: buffer controller for the DCT-coefficient data.

This controller handles

MCU disassembly, including deletion of any dummy

DCT blocks at the right or bottom edge. When reading a multiscan JPEG file, this controller is responsible for buffering the full image.

(Buffering DCT coefficients, rather than samples, is necessary to support progressive JPEG.) The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the source JPEG file is noninterleaved.

* Entropy decoding: Read coded data from the data source module and perform Huffman or arithmetic entropy decoding. Works on one MCU per call.

For progressive JPEG decoding, the coefficient controller supplies the prior coefficients of each MCU (initially all zeroes), which the entropy decoder modifies in each scan.

* Dequantization and inverse DCT: like it says. Note that the coefficients buffered by the coefficient controller have NOT been dequantized; we merge dequantization and inverse DCT into a single step for speed reasons.

When scaled-down

output is asked for, simplified DCT algorithms may be used

that emit fewer samples per DCT block, not the full 8x8. Works on one DCT block at a time.

* Postprocessing controller: buffer controller for the color quantization input buffer, when quantization is in use. (Without quantization, this controller just calls the upsampler.) For two-pass quantization, this controller is responsible for buffering the full-image data.

* Upsampling: restores chroma components to full size. (May support more general output rescaling, too. Note that if undersized DCT outputs have been emitted by the DCT module, this module must adjust so that properly sized outputs are created.) Works on one row group at a time. This module also calls the color conversion module, so its top level is effectively a buffer controller for the upsampling->color conversion buffer. However, in all but the highest-quality operating modes, upsampling and color conversion are likely to be merged into a single step.

* Colorspace conversion: convert from JPEG color space to output color space, and change data layout from separate component planes to pixel-interleaved. Works on one pixel row at a time.

* Color quantization: reduce the data to colormapped form, using either an externally specified colormap or an internally generated one. This module is not used for full-color output. Works on one pixel row at a time; may

require two passes to generate a color map. Note that the output will always be a single component representing colormap indexes. In the current design, the output values are JSAMPLEs, so an 8-bit compilation cannot quantize to more than 256 colors. This is unlikely to be a problem in practice.

* Color reduction: this module handles color precision reduction, e.g., generating 15-bit color (5 bits/primary) from JPEG's 24-bit output. Not quite clear yet how this should be handled... should we merge it with colorspace conversion???

Note

that some high-speed operating modes might condense the entire postprocessing sequence to a single module (upsample, color convert, and quantize in one step).

In addition to the above objects, the decompression library includes these objects:

* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules. This is subdivided into input and output control: `jdinput.c` controls only input-side processing, while `jdmaster.c` handles overall initialization and output-side control.

* Marker reading: decodes JPEG markers (except for RSTn).

* Data source manager: supplies the input JPEG datastream. The source manager supplied with the library knows how to read from a `stdio` stream or from a memory buffer; for other behaviors, the surrounding application may provide its own source manager.

* Memory manager: same as for compression library.

* Error handler: same as for compression library.

* Progress

monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress monitor are candidates for replacement by a surrounding application.

*** Decompression input and output separation ***

To support efficient incremental display of progressive JPEG files, the decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the

coefficient controller's DCT coefficient buffer. Note that this processing is relatively cheap and fast.

2. Data output reads from the DCT coefficient buffer and performs the IDCT and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get arbitrarily far ahead of the data output processing. (This occurs only if the application calls `jpeg_consume_input()`; otherwise input and output run in lockstep, since the input section is called only when the output section needs more data.) In

this way the application can avoid making extra display passes when data is arriving faster than the display pass can run. Furthermore, it is possible to abort an output pass without losing anything, since the coefficient buffer is read-only as far as the output section is concerned. See `libjpeg.txt` for more detail.

A full-image coefficient array is only created if the JPEG file has multiple scans (or if the application specifies buffered-image mode anyway). When reading a single-scan file, the coefficient controller normally creates only a one-MCU buffer, so input and output processing must run in lockstep in this case. `jpeg_consume_input()` is effectively a no-op in this situation.

The main impact of dividing the decompressor in this fashion is that we must be very careful with shared variables in the `cinfo` data structure. Each variable that can change during the course of decompression must be classified as belonging to data input or data output, and each section must look only

at its own variables. For example, the data output section may not depend on any of the variables that describe the current scan in the JPEG file, because these may change as the data input section advances into a new scan.

The progress monitor is (somewhat arbitrarily) defined to treat input of the file as one pass when buffered-image mode is not used, and to ignore data input work completely when buffered-image mode is used. Note that the library has no reliable way to predict the number of passes when dealing with a progressive JPEG file, nor can it predict the number of output passes in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because there isn't any real need for it.

*** Data formats ***

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE; a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW; ptr to a row of samples
typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```

The basic element type JSAMPLE will typically be one of unsigned char, (signed) char, or short. Short will be used if samples wider than 8 bits are to be supported (this is a compile-time option). Otherwise, unsigned char is used if possible. If the compiler only supports signed chars, then it is necessary to mask off the value when reading. Thus, all reads of JSAMPLE values must be coded as "GETJSAMPLE(value)", where the macro will be defined as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be ≥ 0 . This helps simplify correct rounding during downsampling, etc. The JPEG standard's specification that sample values run from -128..127 is accommodated by subtracting 128 from the sample value in the DCT step. Similarly, during decompression the output of the IDCT step will be immediately shifted back to 0..255. (NB: different values are required when 12-bit samples are in use. The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be defined as 255 and 128 respectively in an 8-bit implementation, and as 4095 and 2048 in a 12-bit implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This choice costs only a small amount of memory and has several benefits:

- * Code using the data structure doesn't need to know the allocated width of the rows. This simplifies edge expansion/compression, since we can work in an array that's wider than the logical picture width.
- * Indexing doesn't require multiplication; this is a performance win on many machines.
- * Arrays with more than 64K total elements can be supported even on machines where malloc() cannot allocate chunks larger than 64K.
- * The rows forming a component array may be allocated at different times without extra copying. This trick allows some speedups in smoothing steps that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the traditional layout in which the components of a pixel are stored together. This simplifies coding of modules that work on each component independently, because they don't need to know how many components there are. Furthermore, we can read or write each component to a temporary file independently, which is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as
GETJSAMPLE(image[colorcomponent][row][col])
where col is measured from the image left edge, but row is measured from the

first sample row currently in memory. Either of the first two indexings can be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which the components of a pixel are stored together, the data passed to or from the surrounding

application uses the traditional convention: a single pixel is represented by N consecutive JSAMPLE values, and an image row is an array of (# of color components)*(image width) JSAMPLEs. One or more rows of data can be represented by a pointer of type JSAMPARRAY in this scheme. This scheme is converted to component-wise storage inside the JPEG library. (Applications that want to skip JPEG preprocessing or postprocessing will have to contend with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

```
typedef short JCOEF; a 16-bit signed integer
typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
typedef JBLOCK *JBLOCKROW; ptr to one horizontal row of 8x8 blocks
typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays
```

The underlying type is at least a 16-bit signed integer; while "short" is big enough on all machines of interest, on some machines it is preferable to use "int" for speed reasons, despite the storage cost. Coefficients are grouped into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than "8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged order, and may be true values or divided by the quantization coefficients, depending on where the block is in the processing pipeline. In the current library, coefficient blocks are kept in natural order everywhere; the entropy codecs zigzag or dezigzag the data as it is written or read. The blocks contain quantized coefficients everywhere outside the DCT/IDCT subsystems. (This latter decision may need to be revisited to support variable quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 blocks, corresponding to eight rows of samples. Otherwise the structure is much the same as for samples, and for the same reasons.

On machines where malloc() can't handle a request bigger than 64Kb, this data structure limits us to rows of less than 512 JBLOCKS, or a picture width of 4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW) must be declared as "far" pointers, but the upper levels can be "near" (implying that the pointer lists are allocated in the DS segment). We use a #define symbol FAR, which expands to the "far" keyword when compiling on 80x86 machines and to nothing elsewhere.

*** Suspendable processing ***

In some applications it is desirable to use the JPEG library as an incremental, memory-to-memory filter. In this situation the data source or destination may be a limited-size buffer, and we can't rely on being able to empty or refill the buffer at arbitrary times. Instead the application would like to have control return from the library at buffer overflow/underrun, and then resume compression or decompression at a later time.

This scenario is supported for simple cases. (For anything more complex, we recommend that the application "bite the bullet" and develop real multitasking capability.) The libjpeg.txt file goes into more detail about the usage and limitations of this capability; here we address the implications for library structure.

The essence of the problem is that the entropy codec (coder or decoder) must be prepared to stop at arbitrary times. In turn, the controllers that call the entropy codec must be able to stop before having produced or consumed all the data that they normally would handle in one call. That part is reasonably straightforward: we make the controller call interfaces include "progress counters" which indicate the number of data chunks successfully processed, and we require callers to test the counter rather than just assume all of the data was processed.

Rather than trying to restart at an arbitrary point, the current Huffman codecs are designed to restart at the beginning of the current MCU after a suspension due to buffer overflow/underrun. At the start of each call, the codec's internal state is loaded from permanent storage (in the JPEG object structures) into local variables. On successful completion of the MCU, the permanent state is updated. (This copying is not very expensive, and may even lead to *improved* performance if the local variables can be registerized.) If a suspension occurs, the codec simply returns without updating the state, thus effectively reverting to the start of the MCU. Note that this implies leaving some data unprocessed in the source/destination buffer (ie, the compressed partial MCU). The data source/destination module interfaces are specified so as to make this possible. This also implies that the data buffer must be large enough to hold a worst-case compressed MCU; a couple thousand

bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman decoder has to be able to undo assignments of newly nonzero coefficients if it suspends before the MCU is complete, since decoding requires distinguishing previously-zero and previously-nonzero coefficients. This is a bit tedious but probably won't have much effect on performance. Other variants of Huffman decoding need not worry about this, since they will just store the same values again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its modifiable state is quite large and couldn't be copied cheaply. Instead it would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary point. It does so by backing up to the start of the marker parameter segment, so the data buffer must be big enough to hold the largest marker of interest. Again, a couple KB should be adequate. (A special "skip" convention is used to bypass COM and APPn markers, so these can be larger than the buffer size without causing problems; otherwise a 64K buffer would be needed in the worst case.)

The JPEG marker writer currently does **not** cope with suspension. We feel that this is not necessary; it is much easier simply to require the application to ensure there is enough buffer space before starting. (An empty 2K buffer is more than sufficient for the header markers; and ensuring there are a dozen or two bytes available before calling `jpeg_finish_compress()` will suffice for the trailer.) This would not work for writing multi-scan JPEG files, but we simply do not intend to support that capability with suspension.

*** Memory manager services ***

The JPEG library's memory manager controls allocation and deallocation of memory, and it manages large "virtual" data arrays on machines where the operating system does not provide virtual memory. Note that the same memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or decompression master record, and they will be released when that master record is destroyed.

The memory manager does not provide explicit deallocation of objects. Instead, objects are created in "pools" of free storage, and a whole pool

can be freed at once. This approach helps prevent storage-leak bugs, and it speeds up operations whenever malloc/free are slow (as they often are). The pools can be regarded as lifetime identifiers for objects. Two pools/lifetimes are defined:

- * JPOOL_PERMANENT lasts until master record is destroyed
- * JPOOL_IMAGE lasts until done with image (JPEG datastream)

Permanent lifetime is used for parameters and tables that should be carried across from one datastream to another; this includes all application-visible parameters. Image lifetime is used for everything else. (A third lifetime, JPOOL_PASS = one processing pass, was originally planned. However it was dropped as not being worthwhile. The actual usage patterns are such that the peak memory usage would be about the same anyway; and having per-pass storage substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:

1. "Small" objects. Typically these require no more than 10K-20K total.
2. "Large" objects. These may require tens to hundreds of K depending on image size. Semantically they behave the same as small objects, but we distinguish them for two reasons:
 - * On MS-DOS machines, large objects are referenced by FAR pointers, small objects by NEAR pointers.
 - * Pool allocation heuristics may differ for large and small objects.Note that individual "large" objects cannot exceed the size allowed by type size_t, which may be 64K or less on some machines.
3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKS (typically large enough for the entire image being processed). The memory manager provides stripwise access to these arrays. On machines without virtual memory, the rest of the array may be swapped out to a temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large objects for the data proper and small objects for the row pointers. For convenience and speed, the memory manager provides single routines to create these structures. Similarly, virtual arrays include a small control block and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is not very useful since a virtual array's raison d'etre is to store data for multiple passes through the image.) We also expect that only "small" objects will be given permanent lifespan, though this restriction is not required by the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by making the in-memory buffers for virtual arrays be as large as possible. (For small

images, the buffers might fit entirely in memory, so blind swapping would be very wasteful.) The memory manager will adjust the height of the buffers to fit within a prespecified maximum memory usage. In order to do this in a reasonably optimal fashion, the manager needs to allocate all of the virtual arrays at once. Therefore, there isn't a one-step allocation routine for virtual arrays; instead, there is a "request" routine that simply allocates the control block, and a "realize" routine (called just once) that determines space allocation and creates all of the actual buffers. The realize routine must allow for space occupied by non-virtual large objects. (We don't bother to factor in the space needed for small objects, on the grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business with the memory manager:

1. Modules must request virtual arrays (which may have only image lifespan) during the initial setup phase, i.e., in their `jinit_xxx` routines.
 2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be allocated during initial setup.
 3. `realize_virt_arrays` will be called at the completion of initial setup.
- The above conventions ensure that sufficient information is available for it to choose a good size for virtual array buffers.

Small objects of any lifespan may be allocated at any time. We expect that the total space used for small objects will be small enough to be negligible in the `realize_virt_arrays` computation.

In a virtual-memory machine, we simply pretend that the available space is infinite, thus causing `realize_virt_arrays` to decide that it can allocate all the virtual arrays as full-size in-memory buffers. The overhead of the virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set, never-yet-written sections of the array are set to zero before being made available to the caller. If this flag is not set, never-written sections of the array contain garbage. (This feature exists primarily because the equivalent logic would otherwise be needed in `jdcoefct.c` for progressive JPEG mode; we may as well make it available for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom order; read passes, as well as any write passes after the first one, may access the array in any order. This restriction exists partly to simplify the virtual array control logic, and partly because some file systems may not support seeking beyond the current end-of-file in a temporary file. The main implication of this restriction is that rearrangement of rows (such as converting top-to-bottom data order to bottom-to-top) must be handled while reading data out of the virtual array, not while putting it in.

*** Memory manager internal structure ***

To isolate system dependencies as much as possible, we have broken the memory manager into two parts. There is a reasonably system-independent "front end" (jmemmgr.c) and a "back end" that contains only the code likely to change across systems. All of the memory management methods outlined above are implemented by the front end. The back end provides the following routines for use by the front end (none of these routines are known to the rest of the JPEG code):

jpeg_mem_init, jpeg_mem_term system-dependent initialization/shutdown

jpeg_get_small, jpeg_free_small interface to malloc and free library routines (or their equivalents)

jpeg_get_large, jpeg_free_large interface to FAR malloc/free in MSDOS machines; else usually the same as jpeg_get_small/jpeg_free_small

jpeg_mem_available estimate available memory

jpeg_open_backing_store create a backing-store object

read_backing_store, manipulate a backing-store object
write_backing_store,
close_backing_store

On some systems there will be more than one type of backing-store object (specifically, in MS-DOS a backing store file might be an area of extended memory as well as a disk file). jpeg_open_backing_store is responsible for choosing how to implement a given object. The read/write/close routines are method pointers in the structure that describes a given object; this lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly released upon abnormal program termination. For example, MS-DOS won't free extended memory by itself. To support this, we will expect the main program or surrounding application to arrange to call self_destruct (typically via jpeg_destroy) upon abnormal termination. This may require a SIGINT signal handler or equivalent. We don't want to have the back end module install its own signal handler, because that would pre-empt the surrounding application's ability to control signal handling.

The IJG distribution includes several memory manager back end implementations. Usually

the same back end should be suitable for all applications on a given system, but it is possible for an application to supply its own back end at need.

*** Implications of DNL marker ***

Some JPEG files may use a DNL marker to postpone definition of the image height (this would be useful for a fax-like scanner's output, for instance). In these files the SOF marker claims the image height is 0, and you only find out the true image height at the end of the first scan.

We could read these files as follows:

1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image descriptor.

This implies that control modules must avoid making copies of the image height, and must re-test for termination after each MCU row. This would be easy enough to do.

In cases where image-size data structures are allocated, this approach will result in very inefficient use of virtual memory or much-larger-than-necessary temporary files. This seems acceptable for something that probably won't be a mainstream usage. People might have to forgo use of memory-hogging options (such as two-pass color quantization or noninterleaved JPEG files) if they want efficient conversion of such files. (One could improve efficiency by demanding a user-supplied upper bound for the height, less than 65536; in most cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height, with a DNL to give the true, smaller height at the end of the first scan. This would solve the space problems if the overestimate wasn't too great. However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:

1. Testing for a DNL marker must occur in the inner loop of the decompressor's Huffman decoder; this implies a speed penalty whether the feature is used or not.
2. There is no way to hide the last-minute change in image height from an application using the decoder. Thus *every* application using the IJG library would suffer a complexity penalty whether it cared about DNL or not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using files be preprocessed by a separate program that reads ahead to the DNL, then goes back and fixes the SOF

marker. This is a much simpler solution and is probably far more efficient. Even if one wants piped input, buffering the first scan of the JPEG file needs a lot smaller temp file than is implied by the maximum-height method. For this approach we'd simply treat DNL as a no-op in the decompressor (at most, check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL. Something similar to the first scheme above could be applied if anyone ever wants to make that work.

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/structure.txt
No license file was found, but licenses were detected in source scan.
```

```
/*
* jmemnobs.c
*
* Copyright (C) 1992-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides a really simple implementation of the system-
* dependent portion of the JPEG memory manager. This implementation
* assumes that no backing-store files are needed: all required space
* can be obtained from malloc().
* This is very portable in the sense that it'll compile on almost anything,
* but you'd better have lots of main memory (or virtual memory) if you want
* to process big images.
* Note that the max_memory_to_use option is ignored by this implementation.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmemnobs.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* rdrle.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Utah RLE format.
* The Utah Raster Toolkit library is required (version 3.1 or later).
*
* These routines may need modification for non-Unix environments or
```

* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed RLE format).
*
* Based on code contributed by Mike Lijewski,
* with updates from Robert Hutchinson.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdrle.c
No license file was found, but licenses were detected in source scan.

libjpeg-turbo note: This file has been modified by The libjpeg-turbo Project to include only information relevant to libjpeg-turbo, to wordsmith certain sections, and to remove impolitic language that existed in the libjpeg v8 README. It is included only for reference. Please see README-turbo.txt for information specific to libjpeg-turbo.

The Independent JPEG Group's JPEG software

=====

This distribution contains a release of the Independent JPEG Group's free JPEG software. You are welcome to redistribute this software and to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone, Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson, Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers, and other members of the Independent JPEG Group.

IJG

is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee (also known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP

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This file contains the following sections:

OVERVIEW General description of JPEG and the IJG software.
LEGAL ISSUES Copyright, lack of warranty, terms of distribution.
REFERENCES Where to learn more about JPEG.
ARCHIVE LOCATIONS Where to find newer versions of this software.

FILE FORMAT WARS Software *not* to get.

TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.txt How to configure and install the IJG software.

usage.txt Usage instructions for cjpeg, djpeg, jpegtran,
rdjpgcom, and wrjpgcom.

*.1 Unix-style man pages for programs (same info as usage.txt).

wizard.txt Advanced usage instructions for JPEG wizards only.

change.log Version-to-version

change highlights.

Programmer and internal documentation:

libjpeg.txt How to use the JPEG library in your own programs.

example.c Sample code for calling the JPEG library.

structure.txt Overview of the JPEG library's internal structure.

coderrules.txt Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

OVERVIEW

=====

This package contains C software to implement JPEG image encoding, decoding, and transcoding. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and gray-scale images. JPEG's strong suit is compressing photographic images or other types of images that have smooth color and brightness transitions between neighboring pixels. Images with sharp lines or other abrupt features may not compress well with JPEG, and a higher JPEG quality may have to be used to avoid visible compression artifacts with such images.

JPEG is lossy, meaning that the output pixels are not necessarily identical to the input pixels. However, on photographic content and other "smooth" images, very good compression ratios can be obtained with no visible compression artifacts, and extremely high compression ratios are possible if you are willing to sacrifice image quality (by reducing the "quality" setting in the compressor.)

This software implements JPEG baseline, extended-sequential, and progressive compression processes. Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. We have made no provision for supporting the hierarchical or lossless processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the REFERENCES section for introductory material.) Rather, it is intended to be reliable, portable, industrial-strength code. We do not claim to have achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

LEGAL ISSUES

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In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:

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- (3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

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The Unix configuration script "configure" was produced with GNU Autoconf. It is copyright by the Free Software Foundation but is freely distributable.

The same holds for its supporting scripts (config.guess, config.sub, ltmain.sh). Another support script, install-sh, is copyright by X Consortium but is also freely distributable.

The IJG distribution formerly included code to read and write GIF files.

To avoid entanglement with the Unisys LZW patent, GIF reading support has been removed altogether, and the GIF writer has been simplified to produce "uncompressed GIFs". This technique does not use the LZW algorithm; the resulting GIF files are larger than usual, but are readable by all standard GIF decoders.

We are required to state that

"The Graphics Interchange Format(c) is the Copyright property of CompuServe Incorporated. GIF(sm) is a Service Mark property of CompuServe Incorporated."

REFERENCES

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We recommend reading one or more of these references before trying to understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is

Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44. (Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PostScript file containing a revised version of Wallace's article is available at <http://www.ijg.org/files/wallace.ps.gz>. The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still Image Data Compression Standard" by William B. Pennebaker and Joan L. Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1. Price US\$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2).

The original JPEG standard is divided into two parts, Part 1 being the actual

specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.

The JPEG standard does not specify all details of an interchangeable file format. For the omitted details we follow the "JFIF" conventions, revision 1.02. JFIF 1.02 has been adopted as an Ecma International Technical Report and thus received a formal publication status. It is available as a free download in PDF format from

<http://www.ecma-international.org/publications/techreports/E-TR-098.htm>.

A PostScript version of the JFIF document is available at

<http://www.ijg.org/files/jfif.ps.gz>. There is also a plain text version at

<http://www.ijg.org/files/jfif.txt.gz>, but it is missing the figures.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems.

IJG does not recommend use of the

TIFF 6.0 design (TIFF Compression tag 6).

Instead, we recommend the JPEG design proposed by TIFF Technical Note #2

(Compression tag 7). Copies of this Note can be obtained from

<http://www.ijg.org/files/>. It is expected that the next revision

of the TIFF spec will replace the 6.0 JPEG design with the Note's design.

Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS

=====

The "official" archive site for this software is www.ijg.org.

The most recent released version can always be found there in

directory "files". This particular version will be archived as

<http://www.ijg.org/files/jpegsrc.v8d.tar.gz>, and in Windows-compatible

"zip" archive format as <http://www.ijg.org/files/jpegsr8d.zip>.

The JPEG FAQ (Frequently Asked Questions) article is a source of some general information about JPEG.

It is available on the World Wide Web at <http://www.faqs.org/faqs/jpeg-faq/>

and other

news.answers archive sites, including the official news.answers

archive at rtfm.mit.edu: <ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/>.

If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu

with body

send usenet/news.answers/jpeg-faq/part1

send usenet/news.answers/jpeg-faq/part2

FILE FORMAT WARS

=====

The ISO/IEC JTC1/SC29/WG1 standards committee (also known as JPEG, together with ITU-T SG16) currently promotes different formats containing the name "JPEG" which are incompatible with original DCT-based JPEG. IJG therefore does not support these formats (see REFERENCES). Indeed, one of the original reasons for developing this free software was to help force convergence on common, interoperable format standards for JPEG files.

Don't use an incompatible file format!

(In any case, our decoder will remain capable of reading existing JPEG image files indefinitely.)

TO DO

=====

Please send bug reports, offers of help, etc. to jpeg-info@jpegclub.org.

Found

in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/README
No license file was found, but licenses were detected in source scan.

/*

* jutils.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains tables and miscellaneous utility routines needed

* for both compression and decompression.

* Note we prefix all global names with "j" to minimize conflicts with

* a surrounding application.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jutils.c
No license file was found, but licenses were detected in source scan.

/*

```
* jccolext.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009-2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input colorspace conversion routines.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccolext.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* jdpostct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the decompression postprocessing controller.
* This controller manages the upsampling, color conversion, and color
* quantization/reduction steps; specifically, it controls the buffering
* between upsample/color conversion and color quantization/reduction.
*
* If no color quantization/reduction is required, then this module has no
* work to do, and it just hands off to the upsample/color conversion code.
* An integrated upsample/convert/quantize process would replace this module
* entirely.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdpostct.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* jcapimin.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2003-2010 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
```

* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-compression case or the transcoding-only
* case.
*
* Most of the routines intended to be called directly by an application
* are in this file or in jcapistd.c. But also see jcparam.c for
* parameter-setup helper routines, jcomapi.c for routines shared by
* compression and decompression, and jctrans.c for the transcoding case.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcapimin.c
No license file was found, but licenses were detected in source scan.

/*

* jidctflt.c

*

* Copyright (C) 1994-1998, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a floating-point implementation of the

* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine

* must also perform dequantization of the input coefficients.

*

* This implementation should be more accurate than either of the integer

* IDCT implementations. However, it may not give the same results on all

* machines because of differences in roundoff behavior. Speed will depend

* on the hardware's floating point capacity.

*

* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT

* on each row (or vice versa, but it's more convenient to emit a row at

* a time). Direct algorithms are also available, but they are much more

* complex and seem not to

be any faster when reduced to code.

*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for

* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code

* is based directly on figure 4-8 in P&M.

* While an 8-point DCT cannot be done in less than 11 multiplies, it is

* possible to arrange the computation so that many of the multiplies are

* simple scalings of the final outputs. These multiplies can then be

* folded into the multiplications or divisions by the JPEG quantization

* table entries. The AA&N method leaves only 5 multiplies and 29 adds

* to be done in the DCT itself.

* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values. However, that problem does not arise if
* we
use floating point arithmetic.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctflt.c
No license file was found, but licenses were detected in source scan.

/*

* simd/jsimd.h

*

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright 2011 D. R. Commander

*

* Based on the x86 SIMD extension for IJG JPEG library,

* Copyright (C) 1999-2006, MIYASAKA Masaru.

* For conditions of distribution and use, see copyright notice in jsimdext.inc

*

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd.h
No license file was found, but licenses were detected in source scan.

/*

* jfdctint.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a slow-but-accurate integer implementation of the

* forward DCT (Discrete Cosine Transform).

*

* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT

* on each column. Direct algorithms are also available, but they are

* much more complex and seem not to be any faster when reduced to code.

*

* This implementation is based on an algorithm described in

* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT

* Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,

* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.

* The primary algorithm described there uses 11 multiplies and 29 adds.

- * We use their alternate method with 12 multiplies and 32 adds.
- * The advantage of this method is that no data path contains more than one multiplication; this allows a very simple and accurate implementation in scaled fixed-point arithmetic, with a minimal number of shifts.
- */

Found in path(s):

- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctint.c
- No license file was found, but licenses were detected in source scan.

/*

- * rdtarga.c
- *
- * Copyright (C) 1991-1996, Thomas G. Lane.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains routines to read input images in Targa format.
- *
- * These routines may need modification for non-Unix environments or specialized applications. As they stand, they assume input from an ordinary stdio stream. They further assume that reading begins at the start of the file; start_input may need work if the user interface has already read some data (e.g., to determine that the file is indeed Targa format).
- *
- * Based on code contributed by Lee Daniel Crocker.
- */

Found in path(s):

- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdtarga.c
- No license file was found, but licenses were detected in source scan.

; For conditions of distribution and use, see copyright notice in jsimdext.inc
; more details.

Found in path(s):

- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2int-64.asm
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2int.asm
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2int.asm
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2int-64.asm

*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimtxint.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfmmxint.asm
No license file was found, but licenses were detected in source scan.

/*
* jdmarker.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modifications:
* Copyright (C) 2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to decode JPEG datastream markers.
* Most of the complexity arises from our desire to support input
* suspension: if not all of the data for a marker is available,
* we must exit back to the application. On resumption, we reprocess
* the marker.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmarker.c
No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: CODING RULES

Copyright (C) 1991-1996, Thomas G. Lane.
This file is part of the Independent JPEG Group's software.
For conditions of distribution and use, see the accompanying README file.

Since numerous people will be contributing code and bug fixes, it's important to establish a common coding style. The goal of using similar coding styles is much more important than the details of just what that style is.

In general we follow the recommendations of "Recommended C Style and Coding Standards" revision 6.1 (Cannon et al. as modified by Spencer, Keppel and Brader). This document is available in the IJG FTP archive (see [jpeg/doc/cstyle.ms.tbl.Z](#), or [cstyle.txt.Z](#) for those without nroff/tbl).

Block comments should be laid out thusly:

/*
* Block comments in this style.

*/

We indent statements in K&R style, e.g.,

```
if (test) {
    then-part;
} else {
    else-part;
}
```

with two spaces per indentation

level. (This indentation convention is

handled automatically by GNU Emacs and many other text editors.)

Multi-word names should be written in lower case with underscores, e.g.,

multi_word_name (not multiWordName). Preprocessor symbols and enum constants are similar but upper case (MULTI_WORD_NAME). Names should be unique within the first fifteen characters. (On some older systems, global names must be unique within six characters. We accommodate this without cluttering the source code by using macros to substitute shorter names.)

We use function prototypes everywhere; we rely on automatic source code transformation to feed prototype-less C compilers. Transformation is done by the simple and portable tool 'ansi2knr.c' (courtesy of Ghostscript).

ansi2knr is not very bright, so it imposes a format requirement on function declarations: the function name MUST BEGIN IN COLUMN 1. Thus all functions should be written in the following style:

```
LOCAL(int *)
function_name (int a, char
    *b)
{
    code...
}
```

Note that each function definition must begin with GLOBAL(type), LOCAL(type), or METHODDEF(type). These macros expand to "static type" or just "type" as appropriate. They provide a readable indication of the routine's usage and can readily be changed for special needs. (For instance, special linkage keywords can be inserted for use in Windows DLLs.)

ansi2knr does not transform method declarations (function pointers in structs). We handle these with a macro JMETHOD, defined as

```
#ifdef HAVE_PROTOTYPES
#define JMETHOD(type,methodname,arglist) type (*methodname) arglist
#else
#define JMETHOD(type,methodname,arglist) type (*methodname) ()
#endif
```

which is used like this:

```
struct function_pointers {
```

```
JMETHOD(void, init_entropy_encoder, (int somearg, jparms *jp));  
JMETHOD(void, term_entropy_encoder, (void));  
};
```

Note the set of parentheses surrounding the parameter list.

A similar solution is used for forward and external function declarations (see the EXTERN and JPP macros).

If the code is to work on non-ANSI compilers, we cannot rely on a prototype declaration to coerce actual parameters into the right types. Therefore, use explicit casts on actual parameters whenever the actual parameter type is not identical to the formal parameter. Beware of implicit conversions to "int".

It seems there are some non-ANSI compilers in which the sizeof() operator is defined to return int, yet size_t is defined as long. Needless to say, this is brain-damaged. Always use the SIZEOF() macro in place of sizeof(), so that the result is guaranteed to be of type size_t.

The JPEG library is intended to be used within larger programs. Furthermore, we want it to be reentrant so that it can be used by applications that process multiple images concurrently. The following rules support these requirements:

1. Avoid direct use of file I/O, "malloc", error report printouts, etc; pass these through the common routines provided.
2. Minimize global namespace pollution. Functions should be declared static wherever possible. (Note that our method-based calling conventions help this a lot: in many modules only the initialization function will ever need to be called directly, so only that function need be externally visible.) All global function names should begin with "jpeg_", and should have an abbreviated name (unique in the first six characters) substituted by macro when NEED_SHORT_EXTERNAL_NAMES is set.
3. Don't use global variables; anything that must be used in another module should be in the common data structures.
4. Don't use static variables except for read-only constant tables. Variables that should be private to a module can be placed into private structures (see the system architecture document, structure.txt).
5. Source file names should begin with "j" for files that are part of the library proper; source files that are not part of the library, such as cjpeg.c and djpeg.c, do not begin with "j". Keep source file names to eight characters (plus ".c" or ".h", etc) to make life easy for MS-DOSers. Keep

compression and decompression code in separate source files --- some applications may want only one half of the library.

Note: these rules (particularly #4) are not followed religiously in the modules that are used in cjpeg/djpeg but are not part of the JPEG library proper. Those modules are not really intended to be used in other applications.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/coderules.txt

No license file was found, but licenses were detected in source scan.

/*

* wrppm.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in PPM/PGM format.

* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

* The PBMPLUS library is NOT required to compile this software

* (but it is highly useful as a set of PPM image manipulation programs).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrppm.c

No license file was found, but licenses were detected in source scan.

/*

* jdcolect.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modifications:

* Copyright (C) 2009, 2011, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains output colorspace conversion routines.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcoext.c
No license file was found, but licenses were detected in source scan.

/*

* jsimd.h

*

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright 2011 D. R. Commander

*

* Based on the x86 SIMD extension for IJG JPEG library,

* Copyright (C) 1999-2006, MIYASAKA Masaru.

* For conditions of distribution and use, see copyright notice in jsimdext.inc

*

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimd.h
No license file was found, but licenses were detected in source scan.

/*

* jversion.h

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding.

* Modifications:

* Copyright (C) 2010, 2012-2013, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains software version identification.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jversion.h
No license file was found, but licenses were detected in source scan.

/*

* jsimd_x86_64.c

*

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright 2009-2011 D. R. Commander

*

* Based on the x86 SIMD extension for IJG JPEG library,

* Copyright (C) 1999-2006, MIYASAKA Masaru.

* For conditions of distribution and use, see copyright notice in jsimdext.inc

*
* This file contains the interface between the "normal" portions
* of the library and the SIMD implementations when running on a
* x86_64 architecture.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_x86_64.c
No license file was found, but licenses were detected in source scan.

/*
* jfdctflt.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* forward DCT (Discrete Cosine Transform).
*
* This implementation should be more accurate than either of the integer
* DCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE
E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values. However, that problem does not arise if
* we use floating point arithmetic.
*/

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctflt.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* rdppm.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2009 by Bill Allombert, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in PPM/PGM format.
* The extended 2-byte-per-sample raw PPM/PGM formats are supported.
* The PBMPLUS library is NOT required to compile this software
* (but it is highly useful as a set of PPM image manipulation programs).
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed PPM format).
*/
/* Portions of
this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdppm.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* jinclude.h
*
* Copyright (C) 1991-1994, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
```


* For conditions of distribution and use, see the accompanying README file.
*
* This file exists to provide a single place to fix any problems with
* including the wrong system include files. (Common problems are taken
* care of by the standard jconfig symbols, but on really weird systems
* you may have to edit this file.)
*
* NOTE: this file is NOT intended to be included by applications using the
* JPEG library. Most applications need only include jpeglib.h.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jinclude.h
No license file was found, but licenses were detected in source scan.

/*
* jcrepct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the compression preprocessing controller.
* This controller manages the color conversion, downsampling,
* and edge expansion steps.
*
* Most of the complexity here is associated with buffering input rows
* as required by the downsampler. See the comments at the head of
* jcsample.c for the downsampler's needs.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcrepct.c
No license file was found, but licenses were detected in source scan.

/*
* jpegtran.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1995-2010, Thomas G. Lane, Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for JPEG transcoding.
* It is very similar to cjpeg.c, and partly to djpeg.c, but provides

- * lossless transcoding between different JPEG file formats. It also
- * provides some lossless and sort-of-lossless transformations of JPEG data.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegtran.c
No license file was found, but licenses were detected in source scan.

/*

* rdjpgcom.c

*

- * Copyright (C) 1994-1997, Thomas G. Lane.
- * Modified 2009 by Bill Allombert, Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains a very simple stand-alone application that displays
- * the text in COM (comment) markers in a JFIF file.
- * This may be useful as an example of the minimum logic needed to parse
- * JPEG markers.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdjpgcom.c
No license file was found, but licenses were detected in source scan.

/*

* jccoefct.c

*

- * Copyright (C) 1994-1997, Thomas G. Lane.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains the coefficient buffer controller for compression.
- * This controller is the top level of the JPEG compressor proper.
- * The coefficient buffer lies between forward-DCT and entropy encoding steps.
- */

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccoefct.c
No license file was found, but licenses were detected in source scan.

/*

* cderror.h

*

* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the error and message codes for the cjpeg/djpeg
* applications. These strings are not needed as part of the JPEG library
* proper.
* Edit this file to add new codes, or to translate the message strings to
* some other language.
*/

Found in path(s):

*/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UW7iFaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cderror.h
No license file was found, but licenses were detected in source scan.

/*

* jidctint.c

/*

* Copyright (C) 1991-1998, Thomas G. Lane.
* Modification developed 2002-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a slow-but-accurate integer implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on an algorithm described in
* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
* Algorithms with 11 Multiplications",
* Proc. Int'l. Conf. on Acoustics,
* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies and 29 adds.
* We use their alternate method with 12 multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*
* We also provide IDCT routines with various output sample block sizes for
* direct resolution reduction or enlargement without additional resampling:
* NxN (N=1...16) pixels for one 8x8 input DCT block.

*
* For $N < 8$ we simply take the corresponding low-frequency coefficients of
* the 8×8 input DCT block and apply an $N \times N$ point IDCT on the sub-block
* to yield the downsampled outputs.
* This can be seen as direct low-pass downsampling from the DCT domain
* point of view rather than the usual spatial domain point of view,
* yielding significant computational savings and results at least
* as good as common bilinear (averaging) spatial downsampling.
*
* For $N > 8$ we apply a partial $N \times N$ IDCT on the 8 input coefficients as
* lower frequencies and higher frequencies assumed to be zero.
* It turns out that the computational effort is similar to the 8×8 IDCT
* regarding the output size.
* Furthermore, the scaling and descaling is the same for all IDCT sizes.
*
* CAUTION: We rely on the FIX() macro except for the $N=1,2,4,8$ cases
* since there would be too many additional constants to pre-calculate.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UW7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctint.c
No license file was found, but licenses were detected in source scan.

/*
* jcmaint.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the main buffer controller for compression.
* The main buffer lies between the pre-processor and the JPEG
* compressor proper; it holds downsampled data in the JPEG colorspace.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UW7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmaint.c
No license file was found, but licenses were detected in source scan.

/*
* jcmarker.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write JPEG datastream markers.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmarker.c

No license file was found, but licenses were detected in source scan.

USING THE IJG JPEG LIBRARY

This file was part of the Independent JPEG Group's software:

Copyright (C) 1994-2011, Thomas G. Lane, Guido Vollbeding.

Modifications:

Copyright (C) 2010, D. R. Commander.

For conditions of distribution and use, see the accompanying README file.

This file describes how to use the IJG JPEG library within an application program. Read it if you want to write a program that uses the library.

The file `example.c` provides heavily commented skeleton code for calling the JPEG library. Also see `jpeglib.h` (the include file to be used by application programs) for full details about data structures and function parameter lists. The library source code, of course, is the ultimate reference.

Note that there have been *major* changes from the application interface presented by IJG version 4 and earlier versions. The old design had several inherent limitations, and it had accumulated a lot of cruft

as we added

features while trying to minimize application-interface changes. We have sacrificed backward compatibility in the version 5 rewrite, but we think the improvements justify this.

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You should read at least the overview and basic usage sections before trying to program with the library. The sections on advanced features can be read if and when you need them.

OVERVIEW

=====

Functions provided by the library

The IJG JPEG library provides C code to read and write JPEG-compressed image files. The surrounding application program receives or supplies image data a scanline at a time, using a straightforward uncompressed image format. All details of color conversion and other preprocessing/postprocessing can be handled by the library.

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. The application indirectly selects use of this code by specifying the format in which it wishes to supply or receive image data.

For example, if colormapped output is requested, then the decompression library automatically invokes color quantization.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing,

and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

A word about functions *not* provided by the library. We handle a subset of the ISO JPEG standard; most baseline, extended-sequential, and progressive JPEG processes are supported. (Our subset includes all features now in common use.) Unsupported ISO options include:

- * Hierarchical storage

- * Lossless

JPEG

- * DNL marker

- * Nonintegral subsampling ratios

We support both 8- and 12-bit data precision, but this is a compile-time choice rather than a run-time choice; hence it is difficult to use both precisions in a single application.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, this library is used by the free LIBTIFF library to support JPEG compression in TIFF.)

Outline of typical usage

The rough outline of a JPEG compression operation is:

Allocate and initialize a JPEG compression object

Specify the destination for the compressed data (eg, a file)

Set parameters for compression, including image size & colorspace

```
jpeg_start_compress(...);
```

```
while (scan lines remain to be written)
```

```
    jpeg_write_scanlines(...);
```

```
jpeg_finish_compress(...);
```

Release

the JPEG compression object

A JPEG compression object holds parameters and working state for the JPEG library. We make creation/destruction of the object separate from starting or finishing compression of an image; the same object can be re-used for a series of image compression operations. This makes it easy to re-use the same parameter settings for a sequence of images. Re-use of a JPEG object

also has important implications for processing abbreviated JPEG datastreams, as discussed later.

The image data to be compressed is supplied to `jpeg_write_scanlines()` from in-memory buffers. If the application is doing file-to-file compression, reading image data from the source file is the application's responsibility. The library emits compressed data by calling a "data destination manager", which typically will write the data into a file; but the application can provide its own destination manager to do something else.

Similarly, the rough outline of a JPEG decompression operation is:

```
Allocate and initialize a JPEG decompression object
Specify the source of the compressed data (eg, a file)
Call jpeg_read_header() to obtain image info
Set parameters for decompression
jpeg_start_decompress(...);
while (scan lines remain to be read)
    jpeg_read_scanlines(...);
jpeg_finish_decompress(...);
Release the JPEG decompression object
```

This is comparable to the compression outline except that reading the datastream header is a separate step. This is helpful because information about the image's size, colorspace, etc is available when the application selects decompression parameters. For example, the application can choose an output scaling ratio that will fit the image into the available screen size.

The decompression library obtains compressed data by calling a data source manager, which typically will read the data from a file; but other behaviors can be obtained with a custom source manager. Decompressed data is delivered into in-memory buffers passed to `jpeg_read_scanlines()`.

It is possible to abort an incomplete compression or decompression operation by calling `jpeg_abort()`; or, if you do not need to retain the JPEG object, simply release it by calling `jpeg_destroy()`.

JPEG compression and decompression objects are two separate struct types. However, they share some common fields, and certain routines such as `jpeg_destroy()` can work on either type of object.

The JPEG library has no static variables: all state is in the compression or decompression object. Therefore it is possible to process multiple compression and decompression operations concurrently, using multiple JPEG objects.

Both compression and decompression can be done in an incremental memory-to-memory fashion, if suitable source/destination managers are used. See the section on "I/O suspension" for more details.

BASIC LIBRARY USAGE

=====

Data formats

Before diving into procedural details, it is helpful to understand the image data format that the JPEG library expects or returns.

The standard input image format is a rectangular array of pixels, with each pixel having the same number of "component" or "sample" values (color channels). You must specify how many components there are and the colorspace interpretation of the components. Most applications will use RGB data (three components per pixel) or grayscale data (one component per pixel). PLEASE NOTE THAT RGB DATA IS THREE SAMPLES PER PIXEL, GRAYSCALE ONLY ONE. A remarkable number of people manage to miss this, only to find that their programs don't work with grayscale JPEG files.

There is no provision for colormapped input. JPEG files are always full-color or full grayscale (or sometimes another colorspace such as CMYK). You can feed in a colormapped image by expanding it to full-color format. However JPEG often doesn't work very well with source data that has been colormapped, because of dithering noise. This is discussed in more detail in the JPEG FAQ and the other references mentioned in the README file.

Pixels are stored by scanlines, with each scanline running from left to right. The component values for each pixel are adjacent in the row; for example, R,G,B,R,G,B,R,G,B,... for 24-bit RGB color. Each scanline is an array of data type JSAMPLE --- which is typically "unsigned char", unless you've changed jmorecfg.h. (You can also change the RGB pixel layout, say to B,G,R order, by modifying jmorecfg.h. But see the restrictions listed in that file before doing so.)

A 2-D array of pixels is formed by making a list of pointers to the starts of scanlines; so the scanlines need not be physically adjacent in memory. Even if you process just one scanline at a time, you must make a one-element pointer array to conform to this structure. Pointers to JSAMPLE rows are of type JSAMPROW, and the pointer to the pointer array is of type JSAMPARRAY.

The library accepts or supplies one or more complete scanlines per call. It

is not possible to process part of a row at a time. Scanlines are always processed top-to-bottom. You can process an entire image in one call if you have it all in memory, but usually it's simplest to process one scanline at a time.

For best results, source data values should have the precision specified by `BITS_IN_JSAMPLE` (normally 8 bits). For instance, if you choose to compress data that's only 6 bits/channel, you should left-justify each value in a byte before passing it to the compressor. If you need to compress data that has more than 8 bits/channel, compile with `BITS_IN_JSAMPLE = 12`. (See "Library compile-time options", later.)

The data format returned by the decompressor is the same in all details, except that colormapped output is supported. (Again, a JPEG file is never colormapped. But you can ask the decompressor to perform on-the-fly color quantization to deliver colormapped output.) If you request colormapped output then the returned data array contains a single `JSAMPLE` per pixel; its value is an index into a color map. The color map is represented as a 2-D `JSAMPARRAY` in which each row holds the values of one color component, that is, `colormap[i][j]` is the value of the *i*'th color component for pixel value (map index) *j*. Note that since the colormap indexes are stored in `JSAMPLE`s, the maximum number of colors is limited by the size of `JSAMPLE` (ie, at most 256 colors for an 8-bit JPEG library).

Compression details

Here we revisit the JPEG compression outline given in the overview.

1. Allocate and initialize a JPEG compression object.

A JPEG compression object is a "struct `jpeg_compress_struct`". (It also has a bunch of subsidiary structures which are allocated via `malloc()`, but the application doesn't control those directly.) This struct can be just a local variable in the calling routine, if a single routine is going to execute the whole JPEG compression sequence. Otherwise it can be static or allocated from `malloc()`.

You

will also need a structure representing a JPEG error handler. The part of this that the library cares about is a "struct `jpeg_error_mgr`". If you are providing your own error handler, you'll typically want to embed the `jpeg_error_mgr` struct in a larger structure; this is discussed later under "Error handling". For now we'll assume you are just using the default error handler. The default error handler will print JPEG error/warning messages

on stderr, and it will call exit() if a fatal error occurs.

You must initialize the error handler structure, store a pointer to it into the JPEG object's "err" field, and then call jpeg_create_compress() to initialize the rest of the JPEG object.

Typical code for this step, if you are using the default error handler, is

```
struct jpeg_compress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_compress(&cinfo);
```

jpeg_create_compress allocates a small amount of memory, so it could fail if you are out of memory. In that case it will exit via the error handler; that's why the error handler must be initialized first.

2. Specify the destination for the compressed data (eg, a file).

As previously mentioned, the JPEG library delivers compressed data to a "data destination" module. The library includes one data destination module which knows how to write to a stdio stream. You can use your own destination module if you want to do something else, as discussed later.

If you use the standard destination module, you must open the target stdio stream beforehand. Typical code for this step looks like:

```
FILE * outfile;
...
if ((outfile = fopen(filename, "wb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_dest(&cinfo, outfile);
```

where the last line invokes the standard destination module.

WARNING: it is critical that the binary compressed data be delivered to the output file unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You can select the data destination after setting other parameters (step 3), if that's more convenient. You may not change the destination between calling `jpeg_start_compress()` and `jpeg_finish_compress()`.

3. Set parameters for compression, including image size & colorspace.

You must supply information about the source image by setting the following fields in the JPEG object (cinfo structure):

`image_width` Width of image, in pixels
`image_height` Height of image, in pixels
`input_components` Number of color channels (samples per pixel)
`in_color_space` Color space of source image

The image dimensions are, hopefully, obvious. JPEG supports image dimensions of 1 to 64K pixels in either direction. The input color space is typically RGB or grayscale, and `input_components` is 3 or 1 accordingly. (See "Special color spaces", later, for more info.) The `in_color_space` field must be assigned one of the `J_COLOR_SPACE` enum constants, typically `JCS_RGB` or `JCS_GRAYSCALE`.

JPEG has a large number of compression parameters that determine how the image is encoded. Most applications don't need or want to know about all these parameters. You can set all the parameters to reasonable defaults by calling `jpeg_set_defaults()`; then, if there are particular values you want to change, you can do so after that. The "Compression parameter selection" section tells about all the parameters.

You must set `in_color_space` correctly before calling `jpeg_set_defaults()`, because the defaults depend on the source image colorspace. However the other three source image parameters need not be valid until you call `jpeg_start_compress()`. There's no harm in calling `jpeg_set_defaults()` more than once, if that happens to be convenient.

Typical code for a 24-bit RGB source image is

```
cinfo.image_width = Width; /* image width and height, in pixels */
cinfo.image_height = Height;
cinfo.input_components = 3; /* # of color components per pixel */
cinfo.in_color_space = JCS_RGB; /* colorspace of input image */

jpeg_set_defaults(&cinfo);
/* Make optional parameter settings here */
```

4. jpeg_start_compress(...);

After you have established the data destination and set all the necessary source image info and other parameters, call `jpeg_start_compress()` to begin a compression cycle. This will initialize internal state, allocate working storage, and emit the first few bytes of the JPEG datastream header.

Typical code:

```
jpeg_start_compress(&cinfo, TRUE);
```

The "TRUE" parameter ensures that a complete JPEG interchange datastream will be written. This is appropriate in most cases. If you think you might want to use an abbreviated datastream, read the section on abbreviated datastreams, below.

Once you have called `jpeg_start_compress()`, you may not alter any JPEG parameters or other fields of the JPEG object until you have completed the compression cycle.

5. while (scan lines remain to be written)

```
jpeg_write_scanlines(...);
```

Now write all the required image data by calling `jpeg_write_scanlines()` one or more times. You can pass one or more scanlines in each call, up to the total image height. In most applications it is convenient to pass just one or a few scanlines at a time. The expected format for the passed data is discussed under "Data formats", above.

Image data should be written in top-to-bottom scanline order. The JPEG spec contains some weasel wording about how top and bottom are application-defined terms (a curious interpretation of the English language...) but if you want your files to be compatible with everyone else's, you WILL use top-to-bottom order. If the source data must be read in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently.

Examples of this can be found in the sample application `cjpeg`.

The library maintains a count of the number of scanlines written so far in the `next_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like `"while (cinfo.next_scanline < cinfo.image_height)"`.

Code for this step depends heavily on the way that you store the source data. `example.c` shows the following code for the case of a full-size 2-D source array containing 3-byte RGB pixels:

```

JSAMPROW row_pointer[1]; /* pointer to a single row */
int row_stride; /* physical row width in buffer */

row_stride = image_width * 3; /* JSAMPLEs per row in image_buffer */

while (cinfo.next_scanline < cinfo.image_height) {
    row_pointer[0] = & image_buffer[cinfo.next_scanline * row_stride];
    jpeg_write_scanlines(&cinfo, row_pointer, 1);
}

```

jpeg_write_scanlines() returns the number of scanlines actually written.

This will normally be equal to the number passed in, so you can usually ignore the return value. It is different in just two cases:

- * If you try to write more scanlines than the declared image height, the additional scanlines are ignored.
- * If you use a suspending data destination manager, output buffer overrun will cause the compressor to return before accepting all the passed lines. This feature is discussed under "I/O suspension", below. The normal stdio destination manager will NOT cause this to happen.

In any case, the return value is the same as the change in the value of next_scanline.

6. jpeg_finish_compress(...);

After all the image data has been written, call jpeg_finish_compress() to complete the compression cycle. This step is ESSENTIAL to ensure that the last bufferload of data is written to the data destination.

jpeg_finish_compress() also releases working memory associated with the JPEG object.

Typical code:

```
jpeg_finish_compress(&cinfo);
```

If

using the stdio destination manager, don't forget to close the output stdio stream (if necessary) afterwards.

If you have requested a multi-pass operating mode, such as Huffman code optimization, jpeg_finish_compress() will perform the additional passes using data buffered by the first pass. In this case jpeg_finish_compress() may take quite a while to complete. With the default compression parameters, this will not happen.

It is an error to call jpeg_finish_compress() before writing the necessary

total number of scanlines. If you wish to abort compression, call `jpeg_abort()` as discussed below.

After completing a compression cycle, you may dispose of the JPEG object as discussed next, or you may use it to compress another image. In that case return to step 2, 3, or 4 as appropriate. If you do not change the destination manager, the new datastream will be written to the same target. If you do not change any JPEG parameters, the new datastream will be written with the same parameters as before. Note that you can change the input image dimensions freely between cycles, but if you change the input colorspace, you should call `jpeg_set_defaults()` to adjust for the new colorspace; and then you'll need to repeat all of step 3.

7. Release the JPEG compression object.

When you are done with a JPEG compression object, destroy it by calling `jpeg_destroy_compress()`. This will free all subsidiary memory (regardless of the previous state of the object). Or you can call `jpeg_destroy()`, which works for either compression or decompression objects --- this may be more convenient if you are sharing code between compression and decompression cases. (Actually, these routines are equivalent except for the declared type of the passed pointer. To avoid gripes from ANSI C compilers, `jpeg_destroy()` should be passed a `j_common_ptr`.)

If you allocated the `jpeg_compress_struct` structure from `malloc()`, freeing it is your responsibility --- `jpeg_destroy()` won't. Ditto for the error handler structure.

Typical code:

```
jpeg_destroy_compress(&cinfo);
```

8. Aborting.

If you decide to abort a compression cycle before finishing, you can clean up in either of two ways:

* If you don't need the JPEG object any more, just call `jpeg_destroy_compress()` or `jpeg_destroy()` to release memory. This is legitimate at any point after calling `jpeg_create_compress()` --- in fact, it's safe even if `jpeg_create_compress()` fails.

* If you want to re-use the JPEG object, call `jpeg_abort_compress()`, or call `jpeg_abort()` which works on both compression and decompression objects.

This will return the object to an idle state, releasing any working memory. `jpeg_abort()` is allowed at any time after successful object creation.

Note that cleaning up the data destination, if required, is your responsibility; neither of these routines will call `term_destination()`. (See "Compressed data handling", below, for more about that.)

`jpeg_destroy()` and `jpeg_abort()` are the only safe calls to make on a JPEG object that has reported an error by calling `error_exit` (see "Error handling" for more info). The internal state of such an object is likely to be out of whack. Either of these two routines will return the object to a known state.

Decompression details

Here we revisit the JPEG decompression outline given in the overview.

1. Allocate and initialize a JPEG decompression object.

This is just like initialization for compression, as discussed above, except that the object is a "struct `jpeg_decompress_struct`" and you call `jpeg_create_decompress()`. Error handling is exactly the same.

Typical code:

```
struct jpeg_decompress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_decompress(&cinfo);
```

(Both here and in the IJG code, we usually use variable name "cinfo" for both compression and decompression objects.)

2. Specify the source of the compressed data (eg, a file).

As previously mentioned, the JPEG library reads compressed data from a "data source" module. The library includes one data source module which knows how to read from a stdio stream. You can use your own source module if you want to do something else, as discussed later.

If you use the standard source module, you must open the source stdio stream beforehand. Typical code for this step looks like:


```

FILE * infile;
...
if ((infile = fopen(filename, "rb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_src(&cinfo, infile);

```

where the last line invokes the standard source module.

WARNING: it is critical that the binary compressed data be read unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You may not change the data source between calling jpeg_read_header() and jpeg_finish_decompress(). If you wish to read a series of JPEG images from a single source file, you should repeat the jpeg_read_header() to jpeg_finish_decompress() sequence without reinitializing either the JPEG object or the data source module; this prevents buffered input data from being discarded.

3. Call jpeg_read_header() to obtain image info.

Typical code for this step is just

```
jpeg_read_header(&cinfo, TRUE);
```

This will read the source datastream header markers, up to the beginning of the compressed data proper. On return, the image dimensions and other info have been stored in the JPEG object. The application may wish to consult this information before selecting decompression parameters.

More complex code is necessary if

- * A suspending data source is used --- in that case jpeg_read_header() may return before it has read all the header data. See "I/O suspension", below. The normal stdio source manager will NOT cause this to happen.
- * Abbreviated JPEG files are to be processed --- see the section on abbreviated datastreams. Standard applications that deal only in interchange JPEG files need not be concerned with this case either.

It is permissible to stop at this point if you just wanted to find out the image dimensions and other header info for a JPEG file. In that case, call jpeg_destroy() when you are done with the JPEG object, or call

jpeg_abort() to return it to an idle state before selecting a new data source and reading another header.

4. Set parameters for decompression.

jpeg_read_header() sets appropriate default decompression parameters based on the properties of the image (in particular, its colorspace). However, you may well want to alter these defaults before beginning the decompression. For example, the default is to produce full color output from a color file. If you want colormapped output you must ask for it. Other options allow the returned image to be scaled and allow various speed/quality tradeoffs to be selected. "Decompression parameter selection", below, gives details.

If the defaults are appropriate, nothing need be done at this step.

Note that all default values are set by each call to jpeg_read_header(). If you reuse a decompression object, you cannot expect your parameter settings to be preserved across cycles, as you can for compression. You must set desired parameter values each time.

5. jpeg_start_decompress(...);

Once the parameter values are satisfactory, call jpeg_start_decompress() to begin decompression. This will initialize internal state, allocate working memory, and prepare for returning data.

Typical code is just

```
jpeg_start_decompress(&cinfo);
```

If you have requested a multi-pass operating mode, such as 2-pass color quantization, jpeg_start_decompress() will do everything needed before data output can begin. In this case jpeg_start_decompress() may take quite a while to complete. With a single-scan (non progressive) JPEG file and default decompression parameters, this will not happen; jpeg_start_decompress() will return quickly.

After this call, the final output image dimensions, including any requested scaling, are available in the JPEG object; so is the selected colormap, if colormapped output has been requested. Useful fields include

```
output_width  image width and height, as scaled
output_height
out_color_components # of color components in out_color_space
```

output_components # of color components returned per pixel
colormap the selected colormap, if any
actual_number_of_colors number of entries in colormap

output_components is 1 (a colormap index) when quantizing colors; otherwise it equals out_color_components. It is the number of JSAMPLE values that will be emitted per pixel in the output arrays.

Typically you will need to allocate data buffers to hold the incoming image. You will need output_width * output_components JSAMPLEs per scanline in your output buffer, and a total of output_height scanlines will be returned.

Note: if you are using the JPEG library's internal memory manager to allocate data buffers (as djpeg does), then the manager's protocol requires that you request large buffers *before* calling jpeg_start_decompress(). This is a little tricky since the output_XXX fields are not normally valid then. You can make them valid by calling jpeg_calc_output_dimensions() after setting the relevant parameters (scaling, output color space, and quantization flag).

```
6. while (scan lines remain to be read)
   jpeg_read_scanlines(...);
```

Now you can read the decompressed image data by calling jpeg_read_scanlines() one or more times. At each call, you pass in the maximum number of scanlines to be read (ie, the height of your working buffer); jpeg_read_scanlines() will return up to that many lines. The return value is the number of lines actually read. The format of the returned data is discussed under "Data formats", above. Don't forget that grayscale and color JPEGs will return different data formats!

Image data is returned in top-to-bottom scanline order. If you must write out the image in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently. Examples of this can be found in the sample application djpeg.

The library maintains a count of the number of scanlines returned so far in the output_scanline field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like "while (cinfo.output_scanline < cinfo.output_height)". (Note that the test should NOT be against image_height, unless you never use scaling. The image_height field is the height of the original unscaled image.) The return value always equals the change in the value of output_scanline.

If you don't use a suspending data source, it is safe to assume that jpeg_read_scanlines() reads at least one scanline

per call, until the bottom of the image has been reached.

If you use a buffer larger than one scanline, it is NOT safe to assume that `jpeg_read_scanlines()` fills it. (The current implementation returns only a few scanlines per call, no matter how large a buffer you pass.) So you must always provide a loop that calls `jpeg_read_scanlines()` repeatedly until the whole image has been read.

7. `jpeg_finish_decompress(...)`;

After all the image data has been read, call `jpeg_finish_decompress()` to complete the decompression cycle. This causes working memory associated with the JPEG object to be released.

Typical code:

```
jpeg_finish_decompress(&cinfo);
```

If using the stdio source manager, don't forget to close the source stdio stream if necessary.

It is an error to call `jpeg_finish_decompress()` before reading the correct total number of scanlines. If you wish to abort decompression, call `jpeg_abort()` as discussed below.

After completing a decompression cycle, you may dispose of the JPEG object as discussed next, or you may use it to decompress another image. In that case return to step 2 or 3 as appropriate. If you do not change the source manager, the next image will be read from the same source.

8. Release the JPEG decompression object.

When you are done with a JPEG decompression object, destroy it by calling `jpeg_destroy_decompress()` or `jpeg_destroy()`. The previous discussion of destroying compression objects applies here too.

Typical code:

```
jpeg_destroy_decompress(&cinfo);
```

9. Aborting.

You can abort a decompression cycle by calling `jpeg_destroy_decompress()` or

jpeg_destroy() if you don't need the JPEG object any more, or jpeg_abort_decompress() or jpeg_abort() if you want to reuse the object. The previous discussion of aborting compression cycles applies here too.

Mechanics of usage: include files, linking, etc

Applications using the JPEG library should include the header file jpeglib.h to obtain

declarations of data types and routines. Before including jpeglib.h, include system headers that define at least the typedefs FILE and size_t. On ANSI-conforming systems, including <stdio.h> is sufficient; on older Unix systems, you may need <sys/types.h> to define size_t.

If the application needs to refer to individual JPEG library error codes, also include jerror.h to define those symbols.

jpeglib.h indirectly includes the files jconfig.h and jmorecfg.h. If you are installing the JPEG header files in a system directory, you will want to install all four files: jpeglib.h, jerror.h, jconfig.h, jmorecfg.h.

The most convenient way to include the JPEG code into your executable program is to prepare a library file ("libjpeg.a", or a corresponding name on non-Unix machines) and reference it at your link step. If you use only half of the library (only compression or only decompression), only that much code will be included from the library, unless your linker is hopelessly brain-damaged.

The supplied makefiles build libjpeg.a automatically (see install.txt).

While you can build the JPEG library as a shared library if the whim strikes you, we don't really recommend it. The trouble with shared libraries is that at some point you'll probably try to substitute a new version of the library without recompiling the calling applications. That generally doesn't work because the parameter struct declarations usually change with each new version. In other words, the library's API is **not** guaranteed binary compatible across versions; we only try to ensure source-code compatibility. (In hindsight, it might have been smarter to hide the parameter structs from applications and introduce a ton of access functions instead. Too late now, however.)

On some systems your application may need to set up a signal handler to ensure that temporary files are deleted if the program is interrupted. This is most critical if you are on MS-DOS and use the jmemdos.c memory manager back end; it

will try to grab extended memory for temp files, and that space will NOT be freed automatically. See cjpeg.c or djpeg.c for an example signal handler.

It may be worth pointing out that the core JPEG library does not actually require the stdio library: only the default source/destination managers and error handler need it. You can use the library in a stdio-less environment if you replace those modules and use jmemnobs.c (or another memory manager of your own devising). More info about the minimum system library requirements may be found in jinclude.h.

ADVANCED FEATURES

=====

Compression parameter selection

This section describes all the optional parameters you can set for JPEG compression, as well as the "helper" routines provided to assist in this task. Proper setting of some parameters requires detailed understanding of the JPEG standard; if you don't know what a parameter is for, it's best not to mess with it! See REFERENCES in the README file for pointers to more info about JPEG.

It's a good idea to call jpeg_set_defaults() first, even if you plan to set all the parameters; that way your code is more likely to work with future JPEG libraries that have additional parameters. For the same reason, we recommend you use a helper routine where one is provided, in preference to twiddling cinfo fields directly.

The helper routines are:

jpeg_set_defaults (j_compress_ptr cinfo)

This routine sets all JPEG parameters to reasonable defaults, using only the input image's color space (field in_color_space, which must already be set in cinfo). Many applications will only need to use this routine and perhaps jpeg_set_quality().

jpeg_set_colorspace (j_compress_ptr cinfo, J_COLOR_SPACE colorspace)

Sets the JPEG file's colorspace (field jpeg_color_space) as specified, and sets other color-space-dependent parameters appropriately. See "Special color spaces", below, before using this. A large number of parameters, including all per-component parameters, are set by this routine; if you want to twiddle individual parameters you should call jpeg_set_colorspace() before rather than after.

jpeg_default_colorspace (j_compress_ptr cinfo)

Selects an appropriate JPEG colorspace based on cinfo->in_color_space, and calls jpeg_set_colorspace(). This is actually a subroutine of

jpeg_set_defaults(). It's broken out in case you want to change just the colorspace-dependent JPEG parameters.

jpeg_set_quality (j_compress_ptr cinfo, int quality, boolean force_baseline)

Constructs JPEG quantization tables appropriate for the indicated quality setting. The quality value is expressed on the 0..100 scale recommended by IJG (cjpeg's "-quality" switch uses this routine). Note that the exact mapping from quality values to tables may change in future IJG releases as more is learned about DCT quantization. If the force_baseline parameter is TRUE, then the quantization table entries are constrained to the range 1..255 for full JPEG baseline compatibility. In the current implementation, this only makes a difference for quality settings below 25, and it effectively prevents very small/low quality files from being generated. The IJG decoder is capable of reading the non-baseline files generated at low quality settings when force_baseline is FALSE, but other decoders may not be.

jpeg_set_linear_quality (j_compress_ptr cinfo, int scale_factor, boolean force_baseline)

Same as jpeg_set_quality() except that the generated tables are the sample tables given in the JPEC spec section K.1, multiplied by the specified scale factor (which is expressed as a percentage; thus scale_factor = 100 reproduces the spec's tables). Note that larger scale factors give lower quality. This entry point is useful for conforming to the Adobe PostScript DCT conventions, but we do not recommend linear scaling as a user-visible quality scale otherwise. force_baseline again constrains the computed table entries to 1..255.

int jpeg_quality_scaling (int quality)

Converts a value on the IJG-recommended quality scale to a linear scaling percentage. Note that this routine may change or go away in future releases --- IJG may choose to adopt a scaling method that can't be expressed as a simple scalar multiplier, in which case the premise of this routine collapses. Caveat user.

jpeg_default_qtables (j_compress_ptr cinfo, boolean force_baseline)

[libjpeg v7+ API/ABI emulation only]

Set default quantization tables with linear q_scale_factor[] values (see below).

jpeg_add_quant_table (j_compress_ptr cinfo, int which_tbl, const unsigned int *basic_table, int scale_factor, boolean force_baseline)

Allows an arbitrary quantization table to be created. which_tbl indicates which table slot to fill. basic_table points to an array of 64 unsigned ints given in normal array order. These values are

multiplied by `scale_factor/100` and then clamped to the range

1..65535

(or to 1..255 if `force_baseline` is TRUE).

CAUTION: prior to library version 6a, `jpeg_add_quant_table` expected the basic table to be given in JPEG zigzag order. If you need to write code that works with either older or newer versions of this routine, you must check the library version number. Something like `"#if JPEG_LIB_VERSION >= 61"` is the right test.

`jpeg_simple_progression (j_compress_ptr cinfo)`

Generates a default scan script for writing a progressive-JPEG file.

This is the recommended method of creating a progressive file, unless you want to make a custom scan sequence. You must ensure that the JPEG color space is set correctly before calling this routine.

Compression parameters (cinfo fields) include:

`J_DCT_METHOD` `dct_method`

Selects the algorithm used for the DCT step. Choices are:

`JDCT_ISLOW`: slow but accurate integer algorithm

`JDCT_IFAST`: faster, less accurate integer method

`JDCT_FLOAT`: floating-point method

`JDCT_DEFAULT`: default method (normally

`JDCT_ISLOW`)

`JDCT_FASTEST`: fastest method (normally `JDCT_IFAST`)

The `FLOAT` method is very slightly more accurate than the `ISLOW` method, but may give different results on different machines due to varying roundoff behavior. The integer methods should give the same results on all machines. On machines with sufficiently fast FP hardware, the floating-point method may also be the fastest. The `IFAST` method is considerably less accurate than the other two; its use is not recommended if high quality is a concern. `JDCT_DEFAULT` and `JDCT_FASTEST` are macros configurable by each installation.

`J_COLOR_SPACE` `jpeg_color_space`

`int num_components`

The JPEG color space and corresponding number of components; see "Special color spaces", below, for more info. We recommend using `jpeg_set_color_space()` if you want to change these.

`boolean optimize_coding`

TRUE causes the compressor to compute optimal Huffman coding tables for the image. This requires an extra pass over the data and therefore

costs a good deal of space and time. The default is

FALSE, which tells the compressor to use the supplied or default

Huffman tables. In most cases optimal tables save only a few percent

of file size compared to the default tables. Note that when this is TRUE, you need not supply Huffman tables at all, and any you do supply will be overwritten.

unsigned int restart_interval

int restart_in_rows

To emit restart markers in the JPEG file, set one of these nonzero.

Set restart_interval to specify the exact interval in MCU blocks.

Set restart_in_rows to specify the interval in MCU rows. (If restart_in_rows is not 0, then restart_interval is set after the image width in MCUs is computed.) Defaults are zero (no restarts).

One restart marker per MCU row is often a good choice.

NOTE: the overhead of restart markers is higher in grayscale JPEG files than in color files, and MUCH higher in progressive JPEGs.

If you use restarts, you may want to use larger intervals in those cases.

const jpeg_scan_info * scan_info

int num_scans

By default, scan_info is NULL; this causes the compressor to write a single-scan sequential JPEG file. If not NULL, scan_info points to an array of scan definition records of length num_scans. The compressor will then write a JPEG file having one scan for each scan definition record. This is used to generate noninterleaved or progressive JPEG files. The library checks that the scan array defines a valid JPEG scan sequence. (jpeg_simple_progression creates a suitable scan definition array for progressive JPEG.) This is discussed further under "Progressive JPEG support".

int smoothing_factor

If non-zero, the input image is smoothed; the value should be 1 for minimal smoothing to 100 for maximum smoothing. Consult jcsample.c for details of the smoothing algorithm. The default is zero.

boolean write_JFIF_header

If TRUE, a JFIF APP0 marker is emitted. jpeg_set_defaults() and

jpeg_set_colorspace() set this

TRUE if a JFIF-legal JPEG color space

(ie, YCbCr or grayscale) is selected, otherwise FALSE.

UINT8 JFIF_major_version

UINT8 JFIF_minor_version

The version number to be written into the JFIF marker.

jpeg_set_defaults() initializes the version to 1.01 (major=minor=1).

You should set it to 1.02 (major=1, minor=2) if you plan to write any JFIF 1.02 extension markers.

UINT8 density_unit

UINT16 X_density

UINT16 Y_density

The resolution information to be written into the JFIF marker; not used otherwise. density_unit may be 0 for unknown, 1 for dots/inch, or 2 for dots/cm. The default values are 0,1,1 indicating square pixels of unknown size.

boolean write_Adobe_marker

If TRUE, an Adobe APP14 marker is emitted. jpeg_set_defaults() and jpeg_set_colorspace() set this TRUE if JPEG color space RGB, CMYK, or YCCK is selected, otherwise FALSE. It is generally a bad idea to set both write_JFIF_header and write_Adobe_marker. In fact, you probably shouldn't change the default settings at all --- the default behavior ensures that the JPEG file's color space can be recognized by the decoder.

JQUANT_TBL * quant_tbl_ptrs[NUM_QUANT_TBLS]

Pointers to coefficient quantization tables, one per table slot, or NULL if no table is defined for a slot. Usually these should be set via one of the above helper routines; jpeg_add_quant_table() is general enough to define any quantization table. The other routines will set up table slot 0 for luminance quality and table slot 1 for chrominance.

int q_scale_factor[NUM_QUANT_TBLS]

[libjpeg v7+ API/ABI emulation only]

Linear quantization scaling factors (0-100, default 100)

for use with jpeg_default_qtables().

See rdswitch.c and cjpeg.c for an example of usage.

Note that the q_scale_factor[] values use "linear" scales, so JPEG quality levels chosen by the user must be converted to these scales using jpeg_quality_scaling(). Here is an example that corresponds to cjpeg -quality 90,70:

```
jpeg_set_defaults(cinfo);

/*
Set luminance quality 90. */
cinfo->q_scale_factor[0] = jpeg_quality_scaling(90);
/* Set chrominance quality 70. */
cinfo->q_scale_factor[1] = jpeg_quality_scaling(70);

jpeg_default_qtables(cinfo, force_baseline);
```

CAUTION: Setting separate quality levels for chrominance and luminance is mainly only useful if chrominance subsampling is disabled. 2x2

chrominance subsampling (AKA "4:2:0") is the default, but you can explicitly disable subsampling as follows:

```
cinfo->comp_info[0].v_samp_factor = 1;
cinfo->comp_info[0].h_samp_factor = 1;
```

JHUFF_TBL * dc_huff_tbl_ptrs[NUM_HUFF_TBLS]

JHUFF_TBL * ac_huff_tbl_ptrs[NUM_HUFF_TBLS]

Pointers to Huffman coding tables, one per table slot, or NULL if no table is defined for a slot. Slots 0 and 1 are filled with the JPEG sample tables by `jpeg_set_defaults()`. If you need to allocate more table structures, `jpeg_alloc_huff_table()` may be used.

Note that optimal Huffman tables can be computed for an image by setting `optimize_coding`, as discussed above; there's seldom any need to mess with providing your own Huffman tables.

[libjpeg v7+ API/ABI emulation only]

The actual dimensions of the JPEG image that will be written to the file are given by the following fields. These are computed from the input image dimensions and the compression parameters by `jpeg_start_compress()`. You can also call `jpeg_calc_jpeg_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size.

JDIMENSION jpeg_width Actual dimensions of output image.

JDIMENSION jpeg_height

Per-component parameters are stored in the struct `cinfo.comp_info[i]` for component number `i`. Note that components here refer to components of the JPEG color space, *not* the source image color space. A suitably large `comp_info[]` array is allocated by `jpeg_set_defaults()`; if you choose not to use that routine, it's up to you to allocate the array.

int component_id

The one-byte identifier code to be recorded in the JPEG file for this component. For the standard color spaces, we recommend you leave the default values alone.

int h_samp_factor

int v_samp_factor

Horizontal and vertical sampling factors for the component; must be 1..4 according to the JPEG standard. Note that larger sampling factors indicate a higher-resolution component; many people find this behavior quite unintuitive. The default values are 2,2 for

luminance components and 1,1 for chrominance components, except for grayscale where 1,1 is used.

int quant_tbl_no

Quantization table number for component. The default value is 0 for luminance components and 1 for chrominance components.

int dc_tbl_no

int ac_tbl_no

DC and AC entropy coding table numbers. The default values are 0 for luminance components and 1 for chrominance components.

int component_index

Must equal the component's index in comp_info[]. (Beginning in release v6, the compressor library will fill this in automatically; you don't have to.)

Decompression parameter selection

Decompression parameter selection is somewhat simpler than compression parameter selection, since all of the JPEG internal parameters are recorded in the source file and need not be supplied by the application. (Unless you are working with abbreviated files, in which case see "Abbreviated datastreams", below.) Decompression parameters control the postprocessing done on the image to deliver it in a format suitable for the application's use. Many of the parameters control speed/quality tradeoffs, in which faster decompression may be obtained at the price of a poorer-quality image. The defaults select the highest quality (slowest) processing.

The following fields in the JPEG object are set by jpeg_read_header() and may be useful to the application in choosing decompression parameters:

JDIMENSION image_width Width and height of image
image
JDIMENSION image_height
int num_components Number of color components
J_COLOR_SPACE jpeg_color_space Colorspace of image
boolean saw_JFIF_marker TRUE if a JFIF APP0 marker was seen
UINT8 JFIF_major_version Version information from JFIF marker
UINT8 JFIF_minor_version
UINT8 density_unit Resolution data from JFIF marker
UINT16 X_density
UINT16 Y_density
boolean saw_Adobe_marker TRUE if an Adobe APP14 marker was seen

UINT8 Adobe_transform Color transform code from Adobe marker

The JPEG color space, unfortunately, is something of a guess since the JPEG standard proper does not provide a way to record it. In practice most files adhere to the JFIF or Adobe conventions, and the decoder will recognize these correctly. See "Special color spaces", below, for more info.

The decompression parameters that determine the basic properties of the returned image are:

J_COLOR_SPACE out_color_space

Output color space. jpeg_read_header() sets an appropriate default based

on jpeg_color_space; typically it will be RGB or grayscale.

The application can change this field to request output in a different colorspace. For example, set it to JCS_GRAYSCALE to get grayscale output from a color file. (This is useful for previewing: grayscale output is faster than full color since the color components need not be processed.) Note that not all possible color space transforms are currently implemented; you may need to extend jdcolor.c if you want an unusual conversion.

unsigned int scale_num, scale_denom

Scale the image by the fraction scale_num/scale_denom. Default is 1/1, or no scaling. Currently, the only supported scaling ratios are M/8 with all M from 1 to 16, or any reduced fraction thereof (such as 1/2, 3/4, etc.) (The library design allows for arbitrary scaling ratios but this is not likely to be implemented any time soon.) Smaller scaling ratios permit significantly faster decoding since fewer pixels need be processed and a simpler IDCT method can be used.

boolean quantize_colors

If set TRUE, colormapped output will be delivered. Default is FALSE, meaning that full-color output will be delivered.

The next three parameters are relevant only if quantize_colors is TRUE.

int desired_number_of_colors

Maximum number of colors to use in generating a library-supplied color map (the actual number of colors is returned in a different field).

Default 256. Ignored when the application supplies its own color map.

boolean two_pass_quantize

If TRUE, an extra pass over the image is made to select a custom color map for the image. This usually looks a lot better than the one-size-fits-all colormap that is used otherwise. Default is TRUE. Ignored

when the application supplies its own color map.

`J_DITHER_MODE` `dither_mode`

Selects color dithering method. Supported values are:

`JDITHER_NONE` no dithering: fast, very low quality

`JDITHER_ORDERED` ordered dither: moderate speed and quality

`JDITHER_FS` Floyd-Steinberg

dither: slow, high quality

Default is `JDITHER_FS`. (At present, ordered dither is implemented only in the single-pass, standard-colormap case. If you ask for ordered dither when `two_pass_quantize` is `TRUE` or when you supply an external color map, you'll get F-S dithering.)

When `quantize_colors` is `TRUE`, the target color map is described by the next two fields. `colormap` is set to `NULL` by `jpeg_read_header()`. The application can supply a color map by setting `colormap` non-`NULL` and setting `actual_number_of_colors` to the map size. Otherwise, `jpeg_start_decompress()` selects a suitable color map and sets these two fields itself.

[Implementation restriction: at present, an externally supplied colormap is only accepted for 3-component output color spaces.]

`JSAMPARRAY` `colormap`

The color map, represented as a 2-D pixel array of `out_color_components` rows and `actual_number_of_colors` columns. Ignored if not quantizing.

CAUTION: if the JPEG library creates its own colormap, the storage pointed

to by this field is released by `jpeg_finish_decompress()`.

Copy the colormap somewhere else first, if you want to save it.

`int` `actual_number_of_colors`

The number of colors in the color map.

Additional decompression parameters that the application may set include:

`J_DCT_METHOD` `dct_method`

Selects the algorithm used for the DCT step. Choices are the same as described above for compression.

`boolean` `do_fancy_upsampling`

If `TRUE`, do careful upsampling of chroma components. If `FALSE`, a faster but sloppier method is used. Default is `TRUE`. The visual impact of the sloppier method is often very small.

`boolean` `do_block_smoothing`

If `TRUE`, interblock smoothing is applied in early stages of decoding progressive JPEG files; if `FALSE`, not. Default is `TRUE`. Early progression stages look "fuzzy" with smoothing, "blocky" without.

In any case, block smoothing ceases to be applied after the first few

AC coefficients are known to full accuracy, so it is relevant only when using buffered-image mode for progressive images.

boolean enable_1pass_quant
boolean enable_external_quant
boolean enable_2pass_quant

These are significant only in buffered-image mode, which is described in its own section below.

The output image dimensions are given by the following fields. These are computed from the source image dimensions and the decompression parameters by `jpeg_start_decompress()`. You can also call `jpeg_calc_output_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size. It's also important if you are using the JPEG library's memory manager to allocate output buffer space, because you are supposed to request such buffers *before* `jpeg_start_decompress()`.

JDIMENSION output_width Actual dimensions of output image.
JDIMENSION output_height
int out_color_components Number of color components in out_color_space.
int output_components Number of color components returned.
int rec_outbuf_height Recommended height of scanline buffer.

When quantizing colors, `output_components` is 1, indicating a single color map index per pixel. Otherwise it equals `out_color_components`. The output arrays are required to be `output_width * output_components` JSAMPLEs wide.

`rec_outbuf_height` is the recommended minimum height (in scanlines) of the buffer passed to `jpeg_read_scanlines()`. If the buffer is smaller, the library will still work, but time will be wasted due to unnecessary data copying. In high-quality modes, `rec_outbuf_height` is always 1, but some faster, lower-quality modes set it to larger values (typically 2 to 4). If you are going to ask for a high-speed processing mode, you may as well go to the trouble of honoring `rec_outbuf_height` so as to avoid data copying. (An output buffer larger than `rec_outbuf_height` lines is OK, but won't provide any material speed improvement over that height.)

Special color spaces

The JPEG standard itself is "color blind" and doesn't specify any particular color space. It is customary to convert color data to a luminance/chrominance

color space before compressing, since this permits greater compression. The existing de-facto JPEG file format standards specify YCbCr or grayscale data (JFIF), or grayscale, RGB, YCbCr, CMYK, or YCCK (Adobe). For special applications such as multispectral images, other color spaces can be used, but it must be understood that such files will be unportable.

The JPEG library can handle the most common colorspace conversions (namely RGB \Leftrightarrow YCbCr and CMYK \Leftrightarrow YCCK). It can also deal with data of an unknown color space, passing it through without conversion. If you deal extensively with an unusual color space, you can easily extend the library to understand additional color spaces and perform appropriate conversions.

For compression, the source data's color space is specified by field `in_color_space`. This is transformed to the JPEG file's color space given by `jpeg_color_space`. `jpeg_set_defaults()` chooses a reasonable JPEG color space depending on `in_color_space`, but you can override this by calling `jpeg_set_colorspace()`. Of course you must select a supported transformation. `jpegcolor.c` currently supports the following transformations:

RGB \Rightarrow YCbCr

RGB \Rightarrow GRAYSCALE

YCbCr \Rightarrow GRAYSCALE

CMYK \Rightarrow YCCK

plus the null transforms: GRAYSCALE \Rightarrow GRAYSCALE, RGB \Rightarrow RGB, YCbCr \Rightarrow YCbCr, CMYK \Rightarrow CMYK, YCCK \Rightarrow YCCK, and UNKNOWN \Rightarrow UNKNOWN.

The de-facto file format standards (JFIF and Adobe) specify APPn markers that indicate the color space of the JPEG file. It is important to ensure that these are written correctly, or omitted if the JPEG file's color space is not one of the ones supported by the de-facto standards. `jpeg_set_colorspace()` will set the compression parameters to include or omit the APPn markers properly, so long as it is told the truth about the JPEG color space.

For example, if you are

writing some random 3-component color space without conversion, don't try to fake out the library by setting `in_color_space` and `jpeg_color_space` to `JCS_YCbCr`; use `JCS_UNKNOWN`. You may want to write an APPn marker of your own devising to identify the colorspace --- see "Special markers", below.

When told that the color space is UNKNOWN, the library will default to using luminance-quality compression parameters for all color components. You may well want to change these parameters. See the source code for `jpeg_set_colorspace()`, in `jpegparam.c`, for details.

For decompression, the JPEG file's color space is given in `jpeg_color_space`, and this is transformed to the output color space `out_color_space`.

`jpeg_read_header's` setting of `jpeg_color_space` can be relied on if the file conforms to JFIF or Adobe conventions, but otherwise it is no better than a

guess. If you know the JPEG file's color space for certain, you can override `jpeg_read_header`'s guess by setting `jpeg_color_space`. `jpeg_read_header` also selects a default output color space based on (its guess of) `jpeg_color_space`; set `out_color_space` to override this. Again, you must select a supported transformation. `jdcolor.c` currently supports

- YCbCr => RGB
- YCbCr => GRAYSCALE
- RGB => GRAYSCALE
- GRAYSCALE => RGB
- YCCK => CMYK

as well as the null transforms. (Since GRAYSCALE=>RGB is provided, an application can force grayscale JPEGs to look like color JPEGs if it only wants to handle one case.)

The two-pass color quantizer, `jquant2.c`, is specialized to handle RGB data (it weights distances appropriately for RGB colors). You'll need to modify the code if you want to use it for non-RGB output color spaces. Note that `jquant2.c` is used to map to an application-supplied colormap as well as for the normal two-pass colormap selection process.

CAUTION: it appears that Adobe Photoshop writes inverted data in CMYK JPEG files: 0 represents 100% ink coverage, rather than 0% ink as you'd expect. This is arguably a bug in Photoshop, but if you need to work with Photoshop CMYK files, you will have to deal with it in your application. We cannot "fix" this in the library by inverting the data during the CMYK<=>YCCK transform, because that would break other applications, notably Ghostscript. Photoshop versions prior to 3.0 write EPS files containing JPEG-encoded CMYK data in the same inverted-YCCK representation used in bare JPEG files, but the surrounding PostScript code performs an inversion using the PS image operator. I am told that Photoshop 3.0 will write uninverted YCCK in EPS/JPEG files, and will omit the PS-level inversion. (But the data polarity used in bare JPEG files will not change in 3.0.) In either case, the JPEG library must not invert the data itself, or else Ghostscript would read these EPS files incorrectly.

Error handling

When the default error handler is used, any error detected inside the JPEG routines will cause a message to be printed on `stderr`, followed by `exit()`. You can supply your own error handling routines to override this behavior and to control the treatment of nonfatal warnings and trace/debug messages. The file `example.c` illustrates the most common case, which is to have the application regain control after an error rather than exiting.

The JPEG library never writes any message directly; it always goes through the error handling routines. Three classes of messages are recognized:

- * Fatal errors: the library cannot continue.
- * Warnings: the library can continue, but the data is corrupt, and a damaged output image is likely to result.
- * Trace/informational messages. These come with a trace level indicating the importance of the message; you can control the verbosity of the program by adjusting the maximum trace level that will be displayed.

You may, if you wish, simply replace the entire JPEG error handling module (`jerror.c`) with your own code. However, you can avoid code duplication by only replacing some of the routines depending on the behavior you need.

This is accomplished by calling `jpeg_std_error()` as usual, but then overriding some of the method pointers in the `jpeg_error_mgr` struct, as illustrated by `example.c`.

All of the error handling routines will receive a pointer to the JPEG object (a `j_common_ptr` which points to either a `jpeg_compress_struct` or a `jpeg_decompress_struct`; if you need to tell which, test the `is_decompressor` field). This struct includes a pointer to the error manager struct in its "err" field. Frequently, custom error handler routines will need to access additional data which is not known to the JPEG library or the standard error handler. The most convenient way to do this is to embed either the JPEG object or the `jpeg_error_mgr` struct in a larger structure that contains additional fields; then casting the passed pointer provides access to the additional fields. Again, see `example.c` for one way to do it. (Beginning with IJG version 6b, there is also a void pointer "client_data" in each JPEG object, which the application can also use to find related data. The library does not touch `client_data` at all.)

The individual methods that you might wish to override are:

`error_exit (j_common_ptr cinfo)`

Receives control for a fatal error. Information sufficient to generate the error message has been stored in `cinfo->err`; call `output_message` to display it. Control must NOT return to the caller; generally this routine will `exit()` or `longjmp()` somewhere.

Typically you would override this routine to get rid of the `exit()` default behavior. Note that if you continue processing, you should clean up the JPEG object with `jpeg_abort()` or `jpeg_destroy()`.

`output_message (j_common_ptr cinfo)`

Actual output of any JPEG message. Override this to send messages somewhere other than `stderr`. Note that this method does not know how to generate a message, only where to send it.

`format_message (j_common_ptr cinfo, char * buffer)`

Constructs a readable error

message string based on the error info

stored in `cinfo->err`. This method is called by `output_message`. Few applications should need to override this method. One possible reason for doing so is to implement dynamic switching of error message language.

`emit_message (j_common_ptr cinfo, int msg_level)`

Decide whether or not to emit a warning or trace message; if so,

calls `output_message`. The main reason for overriding this method

would be to abort on warnings. `msg_level` is -1 for warnings,

0 and up for trace messages.

Only `error_exit()` and `emit_message()` are called from the rest of the JPEG library; the other two are internal to the error handler.

The actual message texts are stored in an array of strings which is pointed to by the field `err->jpeg_message_table`. The messages are numbered from 0 to `err->last_jpeg_message`, and it is these code numbers that are used in the JPEG library code. You could replace the message texts (for instance, with messages in French or German)

by changing the message table pointer. See

`jerror.h` for the default texts. CAUTION: this table will almost certainly change or grow from one library version to the next.

It may be useful for an application to add its own message texts that are handled by the same mechanism. The error handler supports a second "add-on" message table for this purpose. To define an addon table, set the pointer `err->addon_message_table` and the message numbers `err->first_addon_message` and `err->last_addon_message`. If you number the addon messages beginning at 1000 or so, you won't have to worry about conflicts with the library's built-in messages. See the sample applications `cjpeg/djpeg` for an example of using addon messages (the addon messages are defined in `cderror.h`).

Actual invocation of the error handler is done via macros defined in `jerror.h`:

`ERREXITn(...)` for fatal errors

`WARNMSn(...)` for corrupt-data warnings

`TRACEMSn(...)` for trace and informational messages.

These macros store the message

code and any additional parameters into the

error handler struct, then invoke the `error_exit()` or `emit_message()` method.

The variants of each macro are for varying numbers of additional parameters.

The additional parameters are inserted into the generated message using standard `printf()` format codes.

See `jerror.h` and `jerror.c` for further details.

Compressed data handling (source and destination managers)

The JPEG compression library sends its compressed data to a "destination manager" module. The default destination manager just writes the data to a memory buffer or to a stdio stream, but you can provide your own manager to do something else. Similarly, the decompression library calls a "source manager" to obtain the compressed data; you can provide your own source manager if you want the data to come from somewhere other than a memory buffer or a stdio stream.

In both cases, compressed data is processed a bufferload at a time: the destination or source manager provides a work buffer, and the library invokes the manager only when the buffer is filled or emptied. (You could define a one-character buffer to force the manager to be invoked for each byte, but that would be rather inefficient.) The buffer's size and location are controlled by the manager, not by the library. For example, the memory source manager just makes the buffer pointer and length point to the original data in memory. In this case the buffer-reload procedure will be invoked only if the decompressor ran off the end of the datastream, which would indicate an erroneous datastream.

The work buffer is defined as an array of datatype JOCTET, which is generally "char" or "unsigned char". On a machine where char is not exactly 8 bits wide, you must define JOCTET as a wider data type and then modify the data source and destination modules to transcribe the work arrays into 8-bit units on external storage.

A data destination manager struct contains a pointer and count defining the next byte to write in the work buffer and the remaining free space:

```
JOCTET * next_output_byte; /* => next byte to write in buffer */
size_t free_in_buffer;    /* # of byte spaces remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is filled. The manager's empty_output_buffer method must reset the pointer and count. The manager is expected to remember the buffer's starting address and total size in private fields not visible to the library.

A data destination manager provides three methods:

```
init_destination (j_compress_ptr cinfo)
Initialize destination. This is called by jpeg_start_compress()
before any data is actually written. It must initialize
```

next_output_byte and free_in_buffer. free_in_buffer must be initialized to a positive value.

empty_output_buffer (j_compress_ptr cinfo)

This is called whenever the buffer has filled (free_in_buffer reaches zero). In typical applications, it should write out the *entire* buffer (use the saved start address and buffer length; ignore the current state of next_output_byte and free_in_buffer). Then reset the pointer & count to the start of the buffer, and return TRUE indicating that the buffer has been dumped. free_in_buffer must be set to a positive value when TRUE is returned. A FALSE return should only be used when I/O suspension is desired (this operating mode is discussed in the next section).

term_destination (j_compress_ptr cinfo)

Terminate destination --- called by jpeg_finish_compress() after all data has been written. In most applications, this must flush any data remaining in the buffer. Use either next_output_byte or free_in_buffer to determine how much data is in the buffer.

term_destination() is NOT called by jpeg_abort() or jpeg_destroy(). If you want the destination manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a jpeg_destination_mgr

struct, fill in its

method pointers, and insert a pointer to the struct into the "dest" field of the JPEG compression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the jpeg_stdio_dest() or jpeg_mem_dest() routines of the supplied destination managers.

Decompression source managers follow a parallel design, but with some additional frammishes. The source manager struct contains a pointer and count defining the next byte to read from the work buffer and the number of bytes remaining:

```
const JOCTET * next_input_byte; /* => next byte to read from buffer */
size_t bytes_in_buffer;      /* # of bytes remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is emptied. The manager's fill_input_buffer method must reset the pointer and count. In most applications, the manager must remember the buffer's starting address and total size in private fields not visible to the library.

A data source manager provides five methods:

init_source (j_decompress_ptr cinfo)

Initialize source. This is called by jpeg_read_header() before any data is actually read. Unlike init_destination(), it may leave bytes_in_buffer set to 0 (in which case a fill_input_buffer() call will occur immediately).

fill_input_buffer (j_decompress_ptr cinfo)

This is called whenever bytes_in_buffer has reached zero and more data is wanted. In typical applications, it should read fresh data into the buffer (ignoring the current state of next_input_byte and bytes_in_buffer), reset the pointer & count to the start of the buffer, and return TRUE indicating that the buffer has been reloaded. It is not necessary to fill the buffer entirely, only to obtain at least one more byte. bytes_in_buffer MUST be set to a positive value if TRUE is returned. A FALSE return should only be used when I/O suspension is desired (this mode is discussed in the next section).

skip_input_data

(j_decompress_ptr cinfo, long num_bytes)

Skip num_bytes worth of data. The buffer pointer and count should be advanced over num_bytes input bytes, refilling the buffer as needed. This is used to skip over a potentially large amount of uninteresting data (such as an APPn marker). In some applications it may be possible to optimize away the reading of the skipped data, but it's not clear that being smart is worth much trouble; large skips are uncommon. bytes_in_buffer may be zero on return. A zero or negative skip count should be treated as a no-op.

resync_to_restart (j_decompress_ptr cinfo, int desired)

This routine is called only when the decompressor has failed to find a restart (RSTn) marker where one is expected. Its mission is to find a suitable point for resuming decompression. For most applications, we recommend that you just use the default resync procedure, jpeg_resync_to_restart(). However, if you are able to back up in the input data stream, or if you have a-priori knowledge about the likely location of restart markers, you may be able to do better. Read the read_restart_marker() and jpeg_resync_to_restart() routines in jdmarker.c if you think you'd like to implement your own resync procedure.

term_source (j_decompress_ptr cinfo)

Terminate source --- called by jpeg_finish_decompress() after all data has been read. Often a no-op.

For both fill_input_buffer() and skip_input_data(), there is no such thing as an EOF return. If the end of the file has been reached, the routine has

a choice of exiting via ERREXIT() or inserting fake data into the buffer. In most cases, generating a warning message and inserting a fake EOI marker is the best course of action --- this will allow the decompressor to output however much of the image is there. In pathological cases, the decompressor may swallow the EOI and again demand data ... just keep feeding it fake EOIs. jdatasrc.c illustrates the recommended error recovery behavior.

term_source() is NOT called by jpeg_abort() or jpeg_destroy(). If you want the source manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a jpeg_source_mgr struct, fill in its method pointers, and insert a pointer to the struct into the "src" field of the JPEG decompression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the jpeg_stdio_src() or jpeg_mem_src() routines of the supplied source managers.

For more information, consult the memory and stdio source and destination managers in jdatasrc.c and jdatadst.c.

I/O suspension

Some applications need to use the JPEG library as an incremental memory-to-memory filter: when the compressed data buffer is filled or emptied, they want control to return to the outer loop, rather than expecting that the buffer can be emptied or reloaded within the data source/destination manager subroutine.

The library supports this need by providing an "I/O suspension" mode, which we describe in this section.

The I/O suspension mode is not a panacea: nothing is guaranteed about the maximum amount of time spent in any one call to the library, so it will not eliminate response-time problems in single-threaded applications. If you need guaranteed response time, we suggest you "bite the bullet" and implement a real multi-tasking capability.

To use I/O suspension, cooperation is needed between the calling application and the data source or destination manager; you will always need a custom source/destination manager. (Please read the previous section if you haven't already.) The basic idea is that the empty_output_buffer() or fill_input_buffer() routine is a no-op, merely returning FALSE to indicate that it has done nothing. Upon seeing this, the JPEG library suspends operation and returns to its caller. The surrounding application is responsible for emptying or refilling the work buffer before calling the JPEG library again.

Compression suspension:

For compression suspension, use an `empty_output_buffer()` routine that returns `FALSE`; typically it will not do anything else. This will cause the compressor to return to the caller of `jpeg_write_scanlines()`, with the return value indicating that not all the supplied scanlines have been accepted. The application must make more room in the output buffer, adjust the output buffer pointer/count appropriately, and then call `jpeg_write_scanlines()` again, pointing to the first unconsumed scanline.

When forced to suspend, the compressor will backtrack to a convenient stopping point (usually the start of the current MCU); it will regenerate some output data when restarted. Therefore, although `empty_output_buffer()` is only called when the buffer is filled, you should NOT write out the entire buffer after a suspension. Write only the data up to the current position of `next_output_byte/free_in_buffer`. The data beyond that point will be regenerated after resumption.

Because of the backtracking behavior, a good-size output buffer is essential for efficiency; you don't want the compressor to suspend often. (In fact, an overly small buffer could lead to infinite looping, if a single MCU required more data than would fit in the buffer.) We recommend a buffer of at least several Kbytes. You may want to insert explicit code to ensure that you don't call `jpeg_write_scanlines()` unless there is a reasonable amount of space in the output buffer; in other words, flush the buffer before trying to compress more data.

The compressor does not allow suspension while it is trying to write JPEG markers at the beginning and end of the file. This means that:

- * At the beginning of a compression operation, there must be enough free space in the output buffer to hold the header markers (typically 600 or so bytes). The recommended buffer size is bigger than this anyway, so this is not a problem as long as you start with an empty buffer. However, this restriction might catch you if you insert large special markers, such as a JFIF thumbnail image, without flushing the buffer afterwards.
- * When you call `jpeg_finish_compress()`, there must be enough space in the output buffer to emit any buffered data and the final EOI marker. In the current implementation, half a dozen bytes should suffice for this, but for safety's sake we recommend ensuring that at least 100 bytes are free before calling `jpeg_finish_compress()`.

A more significant restriction is that `jpeg_finish_compress()` cannot suspend. This means you cannot use suspension with multi-pass operating modes, namely Huffman code optimization and multiple-scan output. Those modes write the whole file during `jpeg_finish_compress()`, which will certainly result in

buffer overrun. (Note that this restriction applies only to compression, not decompression. The decompressor supports input suspension in all of its operating modes.)

Decompression suspension:

For decompression suspension, use a `fill_input_buffer()` routine that simply returns `FALSE` (except perhaps during error recovery, as discussed below). This will cause the decompressor to return to its caller with an indication that suspension has occurred. This can happen at four places:

- * `jpeg_read_header()`: will return `JPEG_SUSPENDED`.
- * `jpeg_start_decompress()`: will return `FALSE`, rather than its usual `TRUE`.
- * `jpeg_read_scanlines()`: will return the number of scanlines already completed (possibly 0).
- * `jpeg_finish_decompress()`: will return `FALSE`, rather than its usual `TRUE`.

The surrounding application must recognize these cases, load more data into the input buffer, and repeat the call. In the case of `jpeg_read_scanlines()`, increment the passed pointers past any scanlines successfully read.

Just as with compression, the decompressor will typically backtrack to a convenient restart point before suspending. When `fill_input_buffer()` is called, `next_input_byte/bytes_in_buffer` point to the current restart point, which is where the decompressor will backtrack to if `FALSE` is returned. The data beyond that position must NOT be discarded if you suspend; it needs to be re-read upon resumption. In most implementations, you'll need to shift this data down to the start of your work buffer and then load more data after it. Again, this behavior means that a several-Kbyte work buffer is essential for decent performance; furthermore, you should load a reasonable amount of new data before resuming decompression. (If you loaded, say, only one new byte each time around, you could waste a LOT of cycles.)

The `skip_input_data()` source manager routine requires special care in a suspension scenario. This routine is NOT granted the ability to suspend the decompressor; it can decrement `bytes_in_buffer` to zero, but no more. If the requested skip distance exceeds the amount of data currently in the input buffer, then `skip_input_data()` must set `bytes_in_buffer` to zero and record the additional skip distance somewhere else. The decompressor will immediately call `fill_input_buffer()`, which should return `FALSE`, which will cause a suspension return. The surrounding application must then arrange to discard the recorded number of bytes before it resumes loading the input buffer. (Yes, this design is rather baroque, but it avoids complexity in the far more common case where a non-suspending source manager is used.)

If the input data has been exhausted, we recommend that you emit a warning and insert dummy EOI markers just as a non-suspending data source manager

would do. This can be handled either in the surrounding application logic or within `fill_input_buffer()`; the latter is probably more efficient. If `fill_input_buffer()` knows that no more data is available, it can set the pointer/count to point to a dummy EOI marker and then return TRUE just as though it had read more data in a non-suspending situation.

The

decompressor does not attempt to suspend within standard JPEG markers; instead it will backtrack to the start of the marker and reprocess the whole marker next time. Hence the input buffer must be large enough to hold the longest standard marker in the file. Standard JPEG markers should normally not exceed a few hundred bytes each (DHT tables are typically the longest). We recommend at least a 2K buffer for performance reasons, which is much larger than any correct marker is likely to be. For robustness against damaged marker length counts, you may wish to insert a test in your application for the case that the input buffer is completely full and yet the decoder has suspended without consuming any data --- otherwise, if this situation did occur, it would lead to an endless loop. (The library can't provide this test since it has no idea whether "the buffer is full", or even whether there is a fixed-size input buffer.)

The input buffer would need to be 64K to allow for arbitrary COM or APPn

markers, but these are handled specially: they are either saved into allocated memory, or skipped over by calling `skip_input_data()`. In the former case, suspension is handled correctly, and in the latter case, the problem of buffer overrun is placed on `skip_input_data`'s shoulders, as explained above. Note that if you provide your own marker handling routine for large markers, you should consider how to deal with buffer overflow.

Multiple-buffer management:

In some applications it is desirable to store the compressed data in a linked list of buffer areas, so as to avoid data copying. This can be handled by having `empty_output_buffer()` or `fill_input_buffer()` set the pointer and count to reference the next available buffer; FALSE is returned only if no more buffers are available. Although seemingly straightforward, there is a pitfall in this approach: the backtrack that occurs when FALSE is returned could back up into an earlier buffer. For example, when `fill_input_buffer()` is

called, the current pointer & count indicate the backtrack restart point. Since `fill_input_buffer()` will set the pointer and count to refer to a new buffer, the restart position must be saved somewhere else. Suppose a second call to `fill_input_buffer()` occurs in the same library call, and no additional input data is available, so `fill_input_buffer` must return FALSE. If the JPEG library has not moved the pointer/count forward in the current buffer, then *the correct restart point is the saved position in the prior buffer*. Prior buffers may be discarded only after the library establishes

a restart point within a later buffer. Similar remarks apply for output into a chain of buffers.

The library will never attempt to backtrack over a `skip_input_data()` call, so any skipped data can be permanently discarded. You still have to deal with the case of skipping not-yet-received data, however.

It's much simpler to use only a single buffer; when `fill_input_buffer()` is called, move any unconsumed data (beyond the current pointer/count) down to the beginning of this buffer and then load new data into the remaining buffer space. This approach requires a little more data copying but is far easier to get right.

Progressive JPEG support

Progressive JPEG rearranges the stored data into a series of scans of increasing quality. In situations where a JPEG file is transmitted across a slow communications link, a decoder can generate a low-quality image very quickly from the first scan, then gradually improve the displayed quality as more scans are received. The final image after all scans are complete is identical to that of a regular (sequential) JPEG file of the same quality setting. Progressive JPEG files are often slightly smaller than equivalent sequential JPEG files, but the possibility of incremental display is the main reason for using progressive JPEG.

The IJG encoder library generates progressive JPEG files when given a suitable "scan script" defining how to divide the data into scans. Creation of progressive JPEG files is otherwise transparent to the encoder. Progressive JPEG files can also be read transparently by the decoder library. If the decoding application simply uses the library as defined above, it will receive a final decoded image without any indication that the file was progressive. Of course, this approach does not allow incremental display. To perform incremental display, an application needs to use the decoder library's "buffered-image" mode, in which it receives a decoded image multiple times.

Each displayed scan requires about as much work to decode as a full JPEG image of the same size, so the decoder must be fairly fast in relation to the data transmission rate in order to make incremental display useful. However, it is possible to skip displaying the image and simply add the incoming bits to the decoder's coefficient buffer. This is fast because only Huffman decoding need be done, not IDCT, upsampling, colorspace conversion, etc.

The IJG decoder library allows the application to switch dynamically between

displaying the image and simply absorbing the incoming bits. A properly coded application can automatically adapt the number of display passes to suit the time available as the image is received. Also, a final higher-quality display cycle can be performed from the buffered data after the end of the file is reached.

Progressive compression:

To create a progressive JPEG file (or a multiple-scan sequential JPEG file), set the scan_info cinfo field to point to an array of scan descriptors, and perform compression as usual. Instead of constructing your own scan list, you can call the jpeg_simple_progression() helper routine to create a recommended progression sequence; this method should be used by all applications that don't want to get involved in the nitty-gritty of progressive scan sequence design. (If you want to provide user control of scan sequences, you may

wish to borrow the scan script reading code found in rdswitch.c, so that you can read scan script files just like cjpeg's.) When scan_info is not NULL, the compression library will store DCT'd data into a buffer array as jpeg_write_scanlines() is called, and will emit all the requested scans during jpeg_finish_compress(). This implies that multiple-scan output cannot be created with a suspending data destination manager, since jpeg_finish_compress() does not support suspension. We should also note that the compressor currently forces Huffman optimization mode when creating a progressive JPEG file, because the default Huffman tables are unsuitable for progressive files.

Progressive decompression:

When buffered-image mode is not used, the decoder library will read all of a multi-scan file during jpeg_start_decompress(), so that it can provide a final decoded image. (Here "multi-scan" means either progressive or multi-scan sequential.) This makes multi-scan files transparent to the decoding application. However, existing applications that used suspending input with version 5 of the IJG library will need to be modified to check for a suspension return from jpeg_start_decompress().

To perform incremental display, an application must use the library's buffered-image mode. This is described in the next section.

Buffered-image mode

In buffered-image mode, the library stores the partially decoded image in a coefficient buffer, from which it can be read out as many times as desired. This mode is typically used for incremental display of progressive JPEG files,

but it can be used with any JPEG file. Each scan of a progressive JPEG file adds more data (more detail) to the buffered image. The application can display in lockstep with the source file (one display pass per input scan), or it can allow input processing to outrun display processing. By making input and display processing run independently, it is possible for the application to adapt progressive display to a wide range of data transmission rates.

The basic control flow for buffered-image decoding is

```
jpeg_create_decompress()
set data source
jpeg_read_header()
set overall decompression parameters
cinfo.buffered_image = TRUE; /* select buffered-image mode */
jpeg_start_decompress()
for (each output pass) {
    adjust output decompression parameters if required
    jpeg_start_output() /* start a new output pass */
    for (all scanlines in image) {
        jpeg_read_scanlines()
        display scanlines
    }
    jpeg_finish_output() /* terminate output pass */
}
jpeg_finish_decompress()
jpeg_destroy_decompress()
```

This differs from ordinary unbuffered decoding in that there is an additional level of looping. The application can choose how many output passes to make and how to display each pass.

The simplest approach to displaying progressive images is to do one display pass for each scan appearing in the input file. In this case the outer loop condition is typically

```
while (! jpeg_input_complete(&cinfo))
and the start-output call should read
jpeg_start_output(&cinfo, cinfo.input_scan_number);
```

The second parameter to `jpeg_start_output()` indicates which scan of the input file is to be displayed; the scans are numbered starting at 1 for this purpose. (You can use a loop counter starting at 1 if you like, but using the library's input scan counter is easier.) The library automatically reads data as necessary to complete each requested scan, and `jpeg_finish_output()` advances to the next scan or end-of-image marker (hence `input_scan_number` will be incremented by the time control arrives back at `jpeg_start_output()`). With this technique, data is read from the input file only as needed, and

input and output processing run in lockstep.

After reading the final scan and reaching the end of the input file, the buffered image remains available; it can be read additional times by repeating the `jpeg_start_output()/jpeg_read_scanlines()/jpeg_finish_output()` sequence.

For example, a useful technique is to use fast one-pass color quantization for display passes made while the image is arriving, followed by a final display pass using two-pass quantization for highest quality. This is done by changing the library parameters before the final output pass. Changing parameters between passes is discussed in detail below.

In general the last scan of a progressive file cannot be recognized as such until after it is read, so a post-input display pass is the best approach if you want special processing in the final pass.

When done with the image, be sure to call `jpeg_finish_decompress()` to release the buffered image (or just use `jpeg_destroy_decompress()`).

If input data arrives faster than it can be displayed, the application can cause the library to decode input data in advance of what's needed to produce output. This is done by calling the routine `jpeg_consume_input()`.

The return value is one of the following:

`JPEG_REACHED_SOS`:

reached an SOS marker (the start of a new scan)

`JPEG_REACHED_EOI`: reached the EOI marker (end of image)

`JPEG_ROW_COMPLETED`: completed reading one MCU row of compressed data

`JPEG_SCAN_COMPLETED`: completed reading last MCU row of current scan

`JPEG_SUSPENDED`: suspended before completing any of the above

(`JPEG_SUSPENDED` can occur only if a suspending data source is used.) This

routine can be called at any time after initializing the JPEG object. It

reads some additional data and returns when one of the indicated significant

events occurs. (If called after the EOI marker is reached, it will

immediately return `JPEG_REACHED_EOI` without attempting to read more data.)

The library's output processing will automatically call `jpeg_consume_input()` whenever the output processing overtakes the input; thus, simple lockstep display requires no direct calls to `jpeg_consume_input()`. But by adding calls to `jpeg_consume_input()`, you can absorb data in advance of what is being displayed.

This has two benefits:

- * You can limit buildup of unprocessed data in your input buffer.
- * You can eliminate extra display passes by paying attention to the state of the library's input processing.

The first of these benefits only requires interspersing calls to `jpeg_consume_input()` with your display operations and any other processing you may be doing. To avoid wasting cycles due to backtracking, it's best to

call `jpeg_consume_input()` only after a hundred or so new bytes have arrived. This is discussed further under "I/O suspension", above. (Note: the JPEG library currently is not thread-safe. You must not call `jpeg_consume_input()` from one thread of control if a different library routine is working on the same JPEG object in another thread.)

When input arrives fast enough that more than one new scan is available before you start a new output pass, you may as well skip the output pass corresponding to the completed scan. This occurs for free if you pass `cinfo.input_scan_number` as the target scan number to `jpeg_start_output()`.

The `input_scan_number` field is simply the index of the scan currently being consumed by the input processor. You can ensure that this is up-to-date by emptying the input buffer just before calling `jpeg_start_output()`: call `jpeg_consume_input()` repeatedly until it returns `JPEG_SUSPENDED` or `JPEG_REACHED_EOI`.

The target scan number passed to `jpeg_start_output()` is saved in the `cinfo.output_scan_number` field. The library's output processing calls `jpeg_consume_input()` whenever the current input scan number and row within that scan is less than or equal to the current output scan number and row. Thus, input processing can "get ahead" of the output processing but is not allowed to "fall behind". You can achieve several different effects by manipulating this interlock rule. For example, if you pass a target scan number greater than the current input scan number, the output processor will wait until that scan starts to arrive before producing any output. (To avoid an infinite loop, the target scan number is automatically reset to the last scan number when the end of image is reached. Thus, if you specify a large target scan number, the library will just absorb the entire input file and then perform an output pass. This is effectively the same as what `jpeg_start_decompress()` does when you don't select buffered-image mode.) When you pass a target scan number equal to the current input scan number, the image is displayed no faster than the current input scan arrives. The final possibility is to pass a target scan number less than the current input scan number; this disables the input/output interlock and causes the output processor to simply display whatever it finds in the image buffer, without waiting for input. (However, the library will not accept a target scan number less than one, so you can't avoid waiting for the first scan.)

When data is arriving faster than the output display processing can advance through the image, `jpeg_consume_input()` will store data into the buffered image beyond the point at which the output processing is reading data out again. If the input arrives fast enough, it may "wrap around" the buffer to the point where the input is more than one whole scan ahead of the output. If the output processing simply proceeds through its display pass without paying attention to the input, the effect seen on-screen is that the lower

part of the image is one or more scans better in quality than the upper part. Then, when the next output scan is started, you have a choice of what target scan number to use. The recommended choice is to use the current input scan number at that time, which implies that you've skipped the output scans corresponding to the input scans that were completed while you processed the previous output scan. In this way, the decoder automatically adapts its speed to the arriving data, by skipping output scans as necessary to keep up with the arriving data.

When using this strategy, you'll want to be sure that you perform a final output pass after receiving all the data; otherwise your last display may not be full quality across the whole screen. So the right outer loop logic is something like this:

```
do {
    absorb any waiting input by calling jpeg_consume_input()
    final_pass = jpeg_input_complete(&cinfo);
    adjust output decompression parameters if required
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
} while (! final_pass);
```

rather than quitting as soon as `jpeg_input_complete()` returns TRUE. This arrangement makes it simple to use higher-quality decoding parameters for the final pass. But if you don't want to use special parameters for the final pass, the right loop logic is like this:

```
for (;;) {
    absorb any waiting input by calling jpeg_consume_input()
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
    if (jpeg_input_complete(&cinfo)
    &&
        cinfo.input_scan_number == cinfo.output_scan_number)
        break;
}
```

In this case you don't need to know in advance whether an output pass is to be the last one, so it's not necessary to have reached EOF before starting the final output pass; rather, what you want to test is whether the output pass was performed in sync with the final input scan. This form of the loop will avoid an extra output pass whenever the decoder is able (or nearly able) to keep up with the incoming data.

When the data transmission speed is high, you might begin a display pass, then find that much or all of the file has arrived before you can complete the pass. (You can detect this by noting the `JPEG_REACHED_EOI` return code from `jpeg_consume_input()`, or equivalently by testing `jpeg_input_complete()`.) In this situation you may wish to abort the current display pass and start a

new one using the newly arrived information. To do so, just call `jpeg_finish_output()` and then start a new pass with `jpeg_start_output()`.

A variant strategy is to abort and restart display if more than one complete scan arrives during an output pass; this can be detected by noting `JPEG_REACHED_SOS` returns and/or examining `cinfo.input_scan_number`. This idea should be employed with caution, however, since the display process might never get to the bottom of the image before being aborted, resulting in the lower part of the screen being several passes worse than the upper. In most cases it's probably best to abort an output pass only if the whole file has arrived and you want to begin the final output pass immediately.

When receiving data across a communication link, we recommend always using the current input scan number for the output target scan number; if a higher-quality final pass is to be done, it should be started (aborting any incomplete output pass) as soon as the end of file is received. However, many other strategies are possible. For example, the application can examine the

parameters of the current input scan and decide whether to display it or not. If the scan contains only chroma data, one might choose not to use it as the target scan, expecting that the scan will be small and will arrive quickly. To skip to the next scan, call `jpeg_consume_input()` until it returns `JPEG_REACHED_SOS` or `JPEG_REACHED_EOI`. Or just use the next higher number as the target scan for `jpeg_start_output()`; but that method doesn't let you inspect the next scan's parameters before deciding to display it.

In buffered-image mode, `jpeg_start_decompress()` never performs input and thus never suspends. An application that uses input suspension with buffered-image mode must be prepared for suspension returns from these routines:

- * `jpeg_start_output()` performs input only if you request 2-pass quantization and the target scan isn't fully read yet. (This is discussed below.)
- * `jpeg_read_scanlines()`, as always, returns the number of scanlines that it was able to produce before suspending.
- * `jpeg_finish_output()` will read any markers following the target scan, up to the end of the file or the SOS marker that begins another scan. (But it reads no input if `jpeg_consume_input()` has already reached the end of the file or a SOS marker beyond the target output scan.)
- * `jpeg_finish_decompress()` will read until the end of file, and thus can suspend if the end hasn't already been reached (as can be tested by calling `jpeg_input_complete()`).

`jpeg_start_output()`, `jpeg_finish_output()`, and `jpeg_finish_decompress()` all return `TRUE` if they completed their tasks, `FALSE` if they had to suspend.

In the event of a `FALSE` return, the application must load more input data and repeat the call. Applications that use non-suspending data sources need

not check the return values of these three routines.

It is possible to change decoding parameters between output passes in the buffered-image mode. The decoder library currently supports only very limited changes of parameters.

ONLY THE FOLLOWING parameter changes are allowed after `jpeg_start_decompress()` is called:

* `dct_method` can be changed before each call to `jpeg_start_output()`.

For example, one could use a fast DCT method for early scans, changing to a higher quality method for the final scan.

* `dither_mode` can be changed before each call to `jpeg_start_output()`; of course this has no impact if not using color quantization. Typically one would use ordered dither for initial passes, then switch to

Floyd-Steinberg dither for the final pass. Caution: changing dither mode can cause more memory to be allocated by the library. Although the amount of memory involved is not large (a scanline or so), it may cause the initial `max_memory_to_use` specification to be exceeded, which in the worst case would result in an out-of-memory failure.

* `do_block_smoothing` can be changed before each call to `jpeg_start_output()`. This setting is relevant only when decoding a progressive JPEG image.

During the first DC-only scan, block smoothing provides a very "fuzzy" look instead of the very "blocky" look seen without it; which is better seems a matter of personal taste. But block smoothing is nearly always a win during later stages, especially when decoding a successive-approximation image: smoothing helps to hide the slight blockiness that otherwise shows up on smooth gradients until the lowest coefficient bits are sent.

* Color quantization mode can be changed under the rules described below. You *cannot* change between full-color and quantized output (because that would alter the required I/O buffer sizes), but you can change which quantization method is used.

When generating color-quantized output, changing quantization method is a very useful way of switching between high-speed and high-quality display. The library allows you to change among its three quantization methods:

1. Single-pass quantization to a fixed color cube.

Selected by `cinfo.two_pass_quantize = FALSE` and `cinfo.colormap = NULL`.

2. Single-pass quantization to an application-supplied colormap.

Selected by setting `cinfo.colormap` to point to the colormap (the value of `two_pass_quantize` is ignored); also set `cinfo.actual_number_of_colors`.

3. Two-pass quantization to a colormap chosen specifically for the image.

Selected by `cinfo.two_pass_quantize = TRUE` and `cinfo.colormap = NULL`. (This is the default setting selected by `jpeg_read_header`, but it is probably NOT what you want for the first pass of progressive display!)

These methods offer successively better quality and lesser speed. However, only the first method is available for quantizing in non-RGB color spaces.

IMPORTANT: because the different quantizer methods have very different working-storage requirements, the library requires you to indicate which one(s) you intend to use before you call `jpeg_start_decompress()`. (If we did not require this, the `max_memory_to_use` setting would be a complete fiction.)

You

do this by setting one or more of these three `cinfo` fields to `TRUE`:

`enable_1pass_quant` Fixed color cube colormap

`enable_external_quant` Externally-supplied colormap

`enable_2pass_quant` Two-pass custom colormap

All three are initialized `FALSE` by `jpeg_read_header()`. But

`jpeg_start_decompress()` automatically sets `TRUE` the one selected by the current `two_pass_quantize` and `colormap` settings, so you only need to set the enable flags for any other quantization methods you plan to change to later.

After setting the enable flags correctly at `jpeg_start_decompress()` time, you can change to any enabled quantization method by setting `two_pass_quantize` and `colormap` properly just before calling `jpeg_start_output()`. The following special rules apply:

1. You must explicitly set `cinfo.colormap` to `NULL` when switching to 1-pass or 2-pass mode from a different mode, or when you want the 2-pass quantizer to be re-run to generate a new colormap.
2. To switch to an external colormap, or to change to a different external colormap than was used on the prior pass, you must call `jpeg_new_colormap()` after setting `cinfo.colormap`.

NOTE: if you want to use the same colormap as was used in the prior pass, you should not do either of these things. This will save some nontrivial switchover costs.

(These requirements exist because `cinfo.colormap` will always be non-`NULL` after completing a prior output pass, since both the 1-pass and 2-pass quantizers set it to point to their output colormaps. Thus you have to do one of these two things to notify the library that something has changed. Yup, it's a bit klugy, but it's necessary to do it this way for backwards compatibility.)

Note that in buffered-image mode, the library generates any requested colormap during `jpeg_start_output()`, not during `jpeg_start_decompress()`.

When using two-pass quantization, `jpeg_start_output()` makes a pass over the buffered image to determine the optimum color map; it therefore may take a significant

amount of time, whereas ordinarily it does little work. The progress monitor hook is called during this pass, if defined. It is also important to realize that if the specified target scan number is greater than or equal to the current input scan number, `jpeg_start_output()` will attempt to consume input as it makes this pass. If you use a suspending data source, you need to check for a `FALSE` return from `jpeg_start_output()` under these

conditions. The combination of 2-pass quantization and a not-yet-fully-read target scan is the only case in which `jpeg_start_output()` will consume input.

Application authors who support buffered-image mode may be tempted to use it for all JPEG images, even single-scan ones. This will work, but it is inefficient: there is no need to create an image-sized coefficient buffer for single-scan images. Requesting buffered-image mode for such an image wastes memory. Worse, it can cost time on large images, since the buffered data has to be swapped out or written to a temporary file. If you are concerned about maximum performance on baseline JPEG files, you should use buffered-image mode only when the incoming file actually has multiple scans. This can be tested by calling `jpeg_has_multiple_scans()`, which will return a correct result at any time after `jpeg_read_header()` completes.

It is also worth noting that when you use `jpeg_consume_input()` to let input processing get ahead of output processing, the resulting pattern of access to the coefficient buffer is quite nonsequential. It's best to use the memory manager `jmemnobs.c` if you can (ie, if you have enough real or virtual main memory). If not, at least make sure that `max_memory_to_use` is set as high as possible. If the JPEG memory manager has to use a temporary file, you will probably see a lot of disk traffic and poor performance. (This could be improved with additional work on the memory manager, but we haven't gotten around to it yet.)

In some applications it may be convenient to use `jpeg_consume_input()` for all input processing, including reading the initial markers; that is, you may wish to call `jpeg_consume_input()` instead of `jpeg_read_header()` during startup. This works, but note that you must check for `JPEG_REACHED_SOS` and `JPEG_REACHED_EOI` return codes as the equivalent of `jpeg_read_header()`'s codes. Once the first SOS marker has been reached, you must call `jpeg_start_decompress()` before `jpeg_consume_input()` will consume more input; it'll just keep returning `JPEG_REACHED_SOS` until you do. If you read a tables-only file this way, `jpeg_consume_input()` will return `JPEG_REACHED_EOI` without ever returning `JPEG_REACHED_SOS`; be sure to check for this case. If this happens, the decompressor will not read any more input until you call `jpeg_abort()` to reset it. It is OK to call `jpeg_consume_input()` even when not using buffered-image mode, but in that case it's basically a no-op after the initial markers have been read: it will just return `JPEG_SUSPENDED`.

Abbreviated
datastreams and multiple images

A JPEG compression or decompression object can be reused to process multiple

images. This saves a small amount of time per image by eliminating the "create" and "destroy" operations, but that isn't the real purpose of the feature. Rather, reuse of an object provides support for abbreviated JPEG datastreams. Object reuse can also simplify processing a series of images in a single input or output file. This section explains these features.

A JPEG file normally contains several hundred bytes worth of quantization and Huffman tables. In a situation where many images will be stored or transmitted with identical tables, this may represent an annoying overhead. The JPEG standard therefore permits tables to be omitted. The standard defines three classes of JPEG datastreams:

- * "Interchange" datastreams contain an image and all tables needed to decode the image. These are the usual kind of JPEG file.

- * "Abbreviated image" datastreams contain an image, but are missing some or all of the tables needed to decode that image.

- * "Abbreviated table specification" (henceforth "tables-only") datastreams contain only table specifications.

To decode an abbreviated image, it is necessary to load the missing table(s) into the decoder beforehand. This can be accomplished by reading a separate tables-only file. A variant scheme uses a series of images in which the first image is an interchange (complete) datastream, while subsequent ones are abbreviated and rely on the tables loaded by the first image. It is assumed that once the decoder has read a table, it will remember that table until a new definition for the same table number is encountered.

It is the application designer's responsibility to figure out how to associate the correct tables with an abbreviated image. While abbreviated datastreams can be useful in a closed environment, their use is strongly discouraged in any situation where data exchange with other applications might be needed. Caveat designer.

The JPEG library provides support for reading and writing any combination of tables-only datastreams and abbreviated images. In both compression and decompression objects, a quantization or Huffman table will be retained for the lifetime of the object, unless it is overwritten by a new table definition.

To create abbreviated image datastreams, it is only necessary to tell the compressor not to emit some or all of the tables it is using. Each quantization and Huffman table struct contains a boolean field "sent_table", which normally is initialized to FALSE. For each table used by the image, the header-writing process emits the table and sets sent_table = TRUE unless it is already TRUE. (In normal usage, this prevents outputting the same table definition multiple times, as would otherwise occur because the chroma components typically share tables.) Thus, setting this field to TRUE before calling

jpeg_start_compress() will prevent the table from being written at all.

If you want to create a "pure" abbreviated image file containing no tables, just call "jpeg_suppress_tables(&cinfo, TRUE)" after constructing all the tables. If you want to emit some but not all tables, you'll need to set the individual sent_table fields directly.

To create an abbreviated image, you must also call jpeg_start_compress() with a second parameter of FALSE, not TRUE. Otherwise jpeg_start_compress() will force all the sent_table fields to FALSE. (This is a safety feature to prevent abbreviated images from being created accidentally.)

To create a tables-only file, perform the same parameter setup that you normally would, but instead of calling jpeg_start_compress() and so on, call jpeg_write_tables(&cinfo). This will write an abbreviated datastream containing only SOI, DQT and/or DHT markers, and EOI. All the quantization and Huffman tables that are currently defined in the compression object will be emitted unless their sent_tables flag is already TRUE, and then all the sent_tables flags will be set TRUE.

A sure-fire way to create matching tables-only and abbreviated image files is to proceed as follows:

```
create JPEG compression object
set JPEG parameters
set destination to tables-only file
jpeg_write_tables(&cinfo);
set destination to image file
jpeg_start_compress(&cinfo, FALSE);
write data...
jpeg_finish_compress(&cinfo);
```

Since the JPEG parameters are not altered between writing the table file and the abbreviated image file, the same tables are sure to be used. Of course, you can repeat the jpeg_start_compress() ... jpeg_finish_compress() sequence many times to produce many abbreviated image files matching the table file.

You cannot suppress output of the computed Huffman tables when Huffman optimization is selected. (If you could, there'd be no way to decode the image...) Generally, you don't want to set optimize_coding = TRUE when you are trying to produce abbreviated files.

In some cases you might want to compress an image using tables which are not stored in the application, but are defined in an interchange or tables-only file readable by the application. This can be done by setting up

a JPEG decompression object to read the specification file, then copying the tables into your compression object. See `jpeg_copy_critical_parameters()` for an example of copying quantization tables.

To read abbreviated image files, you simply need to load the proper tables into the decompression object before trying to read the abbreviated image. If the proper tables are stored in the application program, you can just allocate the table structs and fill in their contents directly. For example, to load a fixed quantization table into table slot "n":

```
if (cinfo.quant_tbl_ptrs[n] == NULL)
    cinfo.quant_tbl_ptrs[n] = jpeg_alloc_quant_table((j_common_ptr) &cinfo);
quant_ptr = cinfo.quant_tbl_ptrs[n]; /* quant_ptr is JQUANT_TBL* */

for (i = 0; i < 64; i++) {
    /* Qtable[] is desired quantization table, in natural array order */
    quant_ptr->quantval[i] = Qtable[i];
}
```

Code to load a fixed Huffman table is typically (for AC table "n"):

```
if (cinfo.ac_huff_tbl_ptrs[n] == NULL)
    cinfo.ac_huff_tbl_ptrs[n] = jpeg_alloc_huff_table((j_common_ptr) &cinfo);
huff_ptr = cinfo.ac_huff_tbl_ptrs[n]; /* huff_ptr is JHUFF_TBL* */
for (i = 1; i <= 16; i++) {
    /* counts[i] is number of Huffman codes of length i bits, i=1..16 */
    huff_ptr->bits[i] = counts[i];
}
for (i = 0; i < 256; i++) {
    /* symbols[] is the list of Huffman symbols, in code-length order */
    huff_ptr->huffval[i] = symbols[i];
}
```

(Note that trying to set `cinfo.quant_tbl_ptrs[n]` to point directly at a constant `JQUANT_TBL` object is not safe. If the incoming file happened to contain a quantization table definition, your master table would get overwritten! Instead allocate a working table copy and copy the master table into it, as illustrated above. Ditto for Huffman tables, of course.)

You might want to read the tables from a tables-only file, rather than hard-wiring them into your application. The `jpeg_read_header()` call is sufficient to read a tables-only file. You must pass a second parameter of `FALSE` to indicate that you do not require an image to be present. Thus, the typical scenario is

create JPEG decompression object

```
set source to tables-only file
jpeg_read_header(&cinfo, FALSE);
set source to abbreviated image file
jpeg_read_header(&cinfo, TRUE);
set decompression parameters
jpeg_start_decompress(&cinfo);
read data...
jpeg_finish_decompress(&cinfo);
```

In some cases, you may want to read a file without knowing whether it contains an image or just tables. In that case, pass `FALSE` and check the return value from `jpeg_read_header()`: it will be `JPEG_HEADER_OK` if an image was found, `JPEG_HEADER_TABLES_ONLY` if only tables were found. (A third return value, `JPEG_SUSPENDED`, is possible when using a suspending data source manager.) Note that `jpeg_read_header()` will not complain if you read an abbreviated image for which you haven't loaded the missing tables; the missing-table check occurs later, in `jpeg_start_decompress()`.

It is possible to read a series of images from a single source file by repeating the `jpeg_read_header() ... jpeg_finish_decompress()` sequence, without releasing/recreating the JPEG object or the data source module. (If you did reinitialize, any partial bufferload left in the data source buffer at the end of one image would be discarded, causing you to lose the start of the next image.) When you use this method, stored tables are automatically carried forward, so some of the images can be abbreviated images that depend on tables from earlier images.

If you intend to write a series of images into a single destination file, you might want to make a specialized data destination module that doesn't flush the output buffer at `term_destination()` time. This would speed things up by some trifling amount. Of course, you'd need to remember to flush the buffer after the last image. You can make the later images be abbreviated ones by passing `FALSE` to `jpeg_start_compress()`.

Special markers

Some applications may need to insert or extract special data in the JPEG datastream. The JPEG standard provides marker types "COM" (comment) and "APP0" through "APP15" (application) to hold application-specific data. Unfortunately, the use of these markers is not specified by the standard. COM markers are fairly widely used to hold user-supplied text. The JFIF file format spec uses APP0 markers with specified initial strings to hold certain data. Adobe applications use APP14 markers beginning with the string "Adobe"

for miscellaneous data. Other APPn markers are rarely seen, but might contain almost anything.

If you wish to store user-supplied text, we recommend you use COM markers and place readable 7-bit ASCII text in them. Newline conventions are not standardized --- expect to find LF (Unix style), CR/LF (DOS style), or CR (Mac style). A robust COM reader should be able to cope with random binary garbage, including nulls, since some applications generate COM markers containing non-ASCII junk. (But yours should not be one of them.)

For program-supplied data, use an APPn marker, and be sure to begin it with an identifying string so that you can tell whether the marker is actually yours. It's probably best to avoid using APP0 or APP14 for any private markers. (NOTE: the upcoming SPIFF standard will use APP8 markers; we recommend you not use APP8 markers for any private purposes, either.)

Keep in mind that at most 65533 bytes can be put into one marker, but you can have as many markers as you like.

By default, the IJG compression library will write a JFIF APP0 marker if the selected JPEG colorspace is grayscale or YCbCr, or an Adobe APP14 marker if the selected colorspace is RGB, CMYK, or YCCK. You can disable this, but we don't recommend it. The decompression library will recognize JFIF and Adobe markers and will set the JPEG colorspace properly when one is found.

You can write special markers immediately following the datastream header by calling `jpeg_write_marker()` after `jpeg_start_compress()` and before the first call to `jpeg_write_scanlines()`. When you do this, the markers appear after the SOI and the JFIF APP0 and Adobe APP14 markers (if written), but before all else. Specify the marker type parameter as "JPEG_COM" for COM or "JPEG_APP0 + n" for APPn. (Actually, `jpeg_write_marker` will let you write any marker type, but we don't recommend writing any other kinds of marker.) For example, to write a user comment string pointed to by `comment_text`:

```
jpeg_write_marker(cinfo, JPEG_COM, comment_text, strlen(comment_text));
```

If it's not convenient to store all the marker data in memory at once, you can instead call `jpeg_write_m_header()` followed by multiple calls to `jpeg_write_m_byte()`. If you do it this way, it's your responsibility to call `jpeg_write_m_byte()` exactly the number of times given in the length parameter to `jpeg_write_m_header()`. (This method lets you empty the output buffer partway through a marker, which might be important when using a suspending data destination module. In any case, if you are using a suspending destination, you should flush its buffer after inserting any special markers. See "I/O suspension".)

Or, if you prefer to synthesize the marker byte sequence yourself, you can just cram it straight into the data destination module.

If you are writing JFIF 1.02 extension markers (thumbnail images), don't forget to set `cinfo.JFIF_minor_version = 2` so that the encoder will write the correct JFIF version number in the JFIF header marker. The library's default is to write version 1.01, but that's wrong if you insert any 1.02 extension markers. (We could probably get away with just defaulting to 1.02, but there used to be broken decoders that would complain about unknown minor version numbers. To reduce compatibility risks it's safest not to write 1.02 unless you are actually using 1.02 extensions.)

When reading, two methods of handling special markers are available:

1. You can ask the library to save the contents of COM and/or APPn markers into memory, and then examine them at your leisure afterwards.
2. You can supply your own routine to process COM and/or APPn markers on-the-fly as they are read.

The first method is simpler to use, especially if you are using a suspending data source; writing a marker processor that copes with input suspension is not easy (consider what happens if the marker is longer than your available input buffer). However, the second method conserves memory since the marker data need not be kept around after it's been processed.

For either method, you'd normally set up marker handling after creating a decompression object and before calling `jpeg_read_header()`, because the markers of interest will typically be near the head of the file and so will be scanned by `jpeg_read_header`. Once you've established a marker handling method, it will be used for the life of that decompression object (potentially many datastreams), unless you change it. Marker handling is determined separately for COM markers and for each APPn marker code.

To save the contents of special markers in memory, call `jpeg_save_markers(cinfo, marker_code, length_limit)` where `marker_code` is the marker type to save, `JPEG_COM` or `JPEG_APP0+n`. (To arrange to save all the special marker types, you need to call this routine 17 times, for COM and APP0-APP15.) If the incoming marker is longer than `length_limit` data bytes, only `length_limit` bytes will be saved; this parameter allows you to avoid chewing up memory when you only need to see the first few bytes of a potentially large marker. If you want to save all the data, set `length_limit` to `0xFFFF`; that is enough since marker lengths are only 16 bits. As a special case, setting `length_limit` to 0 prevents that marker type from being saved at all. (That is the default behavior, in fact.)

After `jpeg_read_header()` completes, you can examine the special markers by following the `cinfo->marker_list` pointer chain. All the special markers in the file appear in this list, in order of their occurrence in the file (but omitting any markers of types you didn't ask for). Both the original data length and the saved data length are recorded for each list entry; the latter will not exceed `length_limit` for the particular marker type. Note that these lengths exclude the marker length word, whereas the stored representation within the JPEG file includes it. (Hence the maximum data length is really only 65533.)

It is possible that additional special markers appear in the file beyond the SOS marker at which `jpeg_read_header` stops; if so, the marker list will be extended during reading of the rest of the file. This is not expected to be common, however. If you are short on memory you may want to reset the length limit to zero for all marker types after finishing `jpeg_read_header`, to ensure that the `max_memory_to_use` setting cannot be exceeded due to addition of later markers.

The marker list remains stored until you call `jpeg_finish_decompress` or `jpeg_abort`, at which point the memory is freed and the list is set to empty. (`jpeg_destroy` also releases the storage, of course.)

Note that the library is internally interested in APP0 and APP14 markers; if you try to set a small nonzero length limit on these types, the library will silently force the length up to the minimum it wants. (But you can set a zero length limit to prevent them from being saved at all.) Also, in a 16-bit environment, the maximum length limit may be constrained to less than 65533 by `malloc()` limitations. It is therefore best not to assume that the effective length limit is exactly what you set it to be.

If you want to supply your own marker-reading routine, you do it by calling `jpeg_set_marker_processor()`. A marker processor routine must have the signature

```
boolean jpeg_marker_parser_method (j_decompress_ptr cinfo)
```

Although the marker code is not explicitly passed, the routine can find it in `cinfo->unread_marker`. At the time of call, the marker proper has been read from the data source module. The processor routine is responsible for reading the marker length word and the remaining parameter bytes, if any. Return TRUE to indicate success. (FALSE should be returned only if you are using a suspending data source and it tells you to suspend. See the standard marker processors in `jdmarker.c` for appropriate coding methods if you need to use a suspending data source.)

If you override the default APP0 or APP14 processors, it is up to you to

recognize JFIF and Adobe markers if you want colorspace recognition to occur properly. We recommend copying and extending the default processors if you want to do that. (A better idea is to save these marker types for later examination by calling `jpeg_save_markers()`; that method doesn't interfere with the library's own processing of these markers.)

`jpeg_set_marker_processor()` and `jpeg_save_markers()` are mutually exclusive --- if you call one it overrides any previous call to the other, for the particular marker type specified.

A simple example of an external COM processor can be found in `djpeg.c`. Also, see `jpegtran.c` for an example of using `jpeg_save_markers`.

Raw (downsampled) image data

Some applications need to supply already-downsampled image data to the JPEG compressor, or to receive raw downsampled data from the decompressor. The library supports this requirement by allowing the application to write or read raw data, bypassing the normal preprocessing or postprocessing steps. The interface is different from the standard one and is somewhat harder to use. If your interest is merely in bypassing color conversion, we recommend that

you use the standard interface and simply set `jpeg_color_space = in_color_space` (or `jpeg_color_space = out_color_space` for decompression). The mechanism described in this section is necessary only to supply or receive downsampled image data, in which not all components have the same dimensions.

To compress raw data, you must supply the data in the colorspace to be used in the JPEG file (please read the earlier section on Special color spaces) and downsampled to the sampling factors specified in the JPEG parameters. You must supply the data in the format used internally by the JPEG library, namely a JSAMPIMAGE array. This is an array of pointers to two-dimensional arrays, each of type JSAMPARRAY. Each 2-D array holds the values for one color component. This structure is necessary since the components are of different sizes. If the image dimensions are not a multiple of the MCU size, you must also pad the data correctly (usually, this is done by replicating the last column and/or row). The data must be padded to a multiple of a DCT block in each component: that is, each downsampled row must contain a multiple of 8 valid samples, and there must be a multiple of 8 sample rows for each component. (For applications such as conversion of digital TV images, the standard image size is usually a multiple of the DCT block size, so that no padding need actually be done.)

The procedure for compression of raw data is basically the same as normal compression, except that you call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. Before calling `jpeg_start_compress()`, you must do the following:

- * Set `cinfo->raw_data_in` to `TRUE`. (It is set `FALSE` by `jpeg_set_defaults()`.) This notifies the library that you will be supplying raw data.
- * Ensure `jpeg_color_space` is correct --- an explicit `jpeg_set_colorspace()` call is a good idea. Note that since color conversion is bypassed, `in_color_space` is ignored, except that `jpeg_set_defaults()` uses it to choose the default `jpeg_color_space` setting.
- * Ensure the sampling factors, `cinfo->comp_info[i].h_samp_factor` and `cinfo->comp_info[i].v_samp_factor`, are correct. Since these indicate the dimensions of the data you are supplying, it's wise to set them explicitly, rather than assuming the library's defaults are what you want.

To pass raw data to the library, call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. The two routines work similarly except that `jpeg_write_raw_data` takes a `JSAMPIMAGE` data array rather than `JSAMPARRAY`. The scanlines count passed to and returned from `jpeg_write_raw_data` is measured in terms of the component with the largest `v_samp_factor`.

`jpeg_write_raw_data()` processes one MCU row per call, which is to say `v_samp_factor*DCTSIZE` sample rows of each component. The passed `num_lines` value must be at least `max_v_samp_factor*DCTSIZE`, and the return value will be exactly that amount (or possibly some multiple of that amount, in future library versions). This is true even on the last call at the bottom of the image; don't forget to pad your data as necessary.

The required dimensions of the supplied data can be computed for each component as

```
cinfo->comp_info[i].width_in_blocks*DCTSIZE  samples per row
cinfo->comp_info[i].height_in_blocks*DCTSIZE rows in image
after jpeg_start_compress() has initialized those fields. If the valid data
is smaller than this, it must be padded appropriately. For some sampling
factors and image sizes, additional dummy DCT blocks are inserted to make
the image a multiple of the MCU dimensions. The library creates such dummy
blocks itself; it does not read them from your supplied data. Therefore you
need never pad by more than DCTSIZE samples. An example may help here.
```

Assume 2h2v downsampling of YCbCr data, that is

```
cinfo->comp_info[0].h_samp_factor = 2  for Y
cinfo->comp_info[0].v_samp_factor = 2
cinfo->comp_info[1].h_samp_factor = 1  for Cb
cinfo->comp_info[1].v_samp_factor = 1
cinfo->comp_info[2].h_samp_factor
= 1  for Cr
cinfo->comp_info[2].v_samp_factor = 1
```

and suppose that the nominal image dimensions (`cinfo->image_width` and `cinfo->image_height`) are 101x101 pixels. Then `jpeg_start_compress()` will compute `downsampled_width = 101` and `width_in_blocks = 13` for Y, `downsampled_width = 51` and `width_in_blocks = 7` for Cb and Cr (and the same for the height fields). You must pad the Y data to at least $13*8 = 104$ columns and rows, the Cb/Cr data to at least $7*8 = 56$ columns and rows. The MCU height is `max_v_samp_factor = 2` DCT rows so you must pass at least 16 scanlines on each call to `jpeg_write_raw_data()`, which is to say 16 actual sample rows of Y and 8 each of Cb and Cr. A total of 7 MCU rows are needed, so you must pass a total of $7*16 = 112$ "scanlines". The last DCT block row of Y data is dummy, so it doesn't matter what you pass for it in the data arrays, but the scanlines count must total up to 112 so that all of the Cb and Cr data gets passed.

Output

suspension is supported with raw-data compression: if the data destination module suspends, `jpeg_write_raw_data()` will return 0. In this case the same data rows must be passed again on the next call.

Decompression with raw data output implies bypassing all postprocessing: you cannot ask for rescaling or color quantization, for instance. More seriously, you must deal with the color space and sampling factors present in the incoming file. If your application only handles, say, 2h1v YCbCr data, you must check for and fail on other color spaces or other sampling factors. The library will not convert to a different color space for you.

To obtain raw data output, set `cinfo->raw_data_out = TRUE` before `jpeg_start_decompress()` (it is set FALSE by `jpeg_read_header()`). Be sure to verify that the color space and sampling factors are ones you can handle. Then call `jpeg_read_raw_data()` in place of `jpeg_read_scanlines()`. The decompression process is otherwise the same as usual.

`jpeg_read_raw_data()`

returns one MCU row per call, and thus you must pass a buffer of at least `max_v_samp_factor*DCTSIZE` scanlines (scanline counting is the same as for raw-data compression). The buffer you pass must be large enough to hold the actual data plus padding to DCT-block boundaries. As with compression, any entirely dummy DCT blocks are not processed so you need not allocate space for them, but the total scanline count includes them. The above example of computing buffer dimensions for raw-data compression is equally valid for decompression.

Input suspension is supported with raw-data decompression: if the data source module suspends, `jpeg_read_raw_data()` will return 0. You can also use buffered-image mode to read raw data in multiple passes.

Really raw data: DCT coefficients

It is possible to read or write the contents of a JPEG file as raw DCT coefficients. This facility is mainly intended for use in lossless transcoding between different JPEG file formats. Other possible applications include lossless cropping of a JPEG image, lossless reassembly of a multi-strip or multi-tile TIFF/JPEG file into a single JPEG datastream, etc.

To read the contents of a JPEG file as DCT coefficients, open the file and do `jpeg_read_header()` as usual. But instead of calling `jpeg_start_decompress()` and `jpeg_read_scanlines()`, call `jpeg_read_coefficients()`. This will read the entire image into a set of virtual coefficient-block arrays, one array per component. The return value is a pointer to an array of virtual-array descriptors. Each virtual array can be accessed directly using the JPEG memory manager's `access_virt_barray` method (see Memory management, below, and also read `structure.txt`'s discussion of virtual array handling). Or, for simple transcoding to a different JPEG file format, the array list can just be handed directly to `jpeg_write_coefficients()`.

Each block in the block arrays contains quantized coefficient values in normal array order (not JPEG zigzag order). The block arrays contain only DCT blocks containing real data; any entirely-dummy blocks added to fill out interleaved MCUs at the right or bottom edges of the image are discarded during reading and are not stored in the block arrays. (The size of each block array can be determined from the `width_in_blocks` and `height_in_blocks` fields of the component's `comp_info` entry.) This is also the data format expected by `jpeg_write_coefficients()`.

When you are done using the virtual arrays, call `jpeg_finish_decompress()` to release the array storage and return the decompression object to an idle state; or just call `jpeg_destroy()` if you don't need to reuse the object.

If you use a suspending data source, `jpeg_read_coefficients()` will return NULL if it is forced to suspend; a non-NULL return value indicates successful completion. You need not test for a NULL return value when using a non-suspending data source.

It is also possible to call `jpeg_read_coefficients()` to obtain access to the decoder's coefficient arrays during a normal decode cycle in buffered-image mode. This frammish might be useful for progressively displaying an incoming image and then re-encoding it without loss. To do this, decode in buffered-image mode as discussed previously, then call `jpeg_read_coefficients()` after the last `jpeg_finish_output()` call. The arrays will be available for your use until you call `jpeg_finish_decompress()`.

To write the contents of a JPEG file as DCT coefficients, you must provide the DCT coefficients stored in virtual block arrays. You can either pass block arrays read from an input JPEG file by `jpeg_read_coefficients()`, or allocate virtual arrays from the JPEG compression object and fill them yourself. In either case, `jpeg_write_coefficients()` is substituted for `jpeg_start_compress()` and `jpeg_write_scanlines()`. Thus the sequence is

- * Create compression object
- * Set all compression parameters as necessary
- * Request virtual arrays
if needed
- * `jpeg_write_coefficients()`
- * `jpeg_finish_compress()`
- * Destroy or re-use compression object

`jpeg_write_coefficients()` is passed a pointer to an array of virtual block array descriptors; the number of arrays is equal to `cinfo.num_components`.

The virtual arrays need only have been requested, not realized, before `jpeg_write_coefficients()` is called. A side-effect of `jpeg_write_coefficients()` is to realize any virtual arrays that have been requested from the compression object's memory manager. Thus, when obtaining the virtual arrays from the compression object, you should fill the arrays after calling `jpeg_write_coefficients()`. The data is actually written out when you call `jpeg_finish_compress()`; `jpeg_write_coefficients()` only writes the file header.

When writing raw DCT coefficients, it is crucial that the JPEG quantization tables and sampling factors match the way the data was encoded, or the resulting file will be invalid. For transcoding from an existing JPEG file, we recommend using `jpeg_copy_critical_parameters()`. This routine initializes all the compression parameters to default values (like `jpeg_set_defaults()`), then copies the critical information from a source decompression object. The decompression object should have just been used to read the entire JPEG input file --- that is, it should be awaiting `jpeg_finish_decompress()`.

`jpeg_write_coefficients()` marks all tables stored in the compression object as needing to be written to the output file (thus, it acts like `jpeg_start_compress(cinfo, TRUE)`). This is for safety's sake, to avoid emitting abbreviated JPEG files by accident. If you really want to emit an abbreviated JPEG file, call `jpeg_suppress_tables()`, or set the tables' individual `sent_table` flags, between calling `jpeg_write_coefficients()` and `jpeg_finish_compress()`.

Progress monitoring

Some applications may need to regain control from the JPEG library every so often. The typical use of this feature is to produce a percent-done bar or other progress display. (For a simple example, see `cjpeg.c` or `djpeg.c`.) Although you do get control back frequently during the data-transferring pass (the `jpeg_read_scanlines` or `jpeg_write_scanlines` loop), any additional passes will occur inside `jpeg_finish_compress` or `jpeg_start_decompress`; those routines may take a long time to execute, and you don't get control back until they are done.

You can define a progress-monitor routine which will be called periodically by the library. No guarantees are made about how often this call will occur, so we don't recommend you use it for mouse tracking or anything like that. At present, a call will occur once per MCU row, scanline, or sample row group, whichever unit is convenient for the current processing mode; so the wider the image, the longer the time between calls. During the data transferring pass, only one call occurs per call of `jpeg_read_scanlines` or `jpeg_write_scanlines`, so don't pass a large number of scanlines at once if you want fine resolution in the progress count. (If you really need to use the callback mechanism for time-critical tasks like mouse tracking, you could insert additional calls inside some of the library's inner loops.)

To establish a progress-monitor callback, create a struct `jpeg_progress_mgr`, fill in its `progress_monitor` field with a pointer to your callback routine, and set `cinfo->progress` to point to the struct. The callback will be called whenever `cinfo->progress` is non-NULL. (This pointer is set to NULL by `jpeg_create_compress` or `jpeg_create_decompress`; the library will not change it thereafter. So if you allocate dynamic storage for the progress struct, make sure it will live as long as the JPEG object does. Allocating from the JPEG memory manager with lifetime `JPOOL_PERMANENT` will work nicely.) You can use the same callback routine for both compression and decompression.

The `jpeg_progress_mgr` struct contains four fields which are set by the library:

```
long pass_counter; /* work units completed in this pass */
long pass_limit; /* total number of work units in this pass */
int completed_passes; /* passes completed so far */
int total_passes; /* total number of passes expected */
```

During any one pass, `pass_counter` increases from 0 up to (not including) `pass_limit`; the step size is usually but not necessarily 1. The `pass_limit` value may change from one pass to another. The expected total number of passes is in `total_passes`, and the number of passes already completed is in `completed_passes`. Thus the fraction of work completed may be estimated as

```
-----
total_passes
```

ignoring the fact that the passes may not be equal amounts of work.

When decompressing, `pass_limit` can even change within a pass, because it depends on the number of scans in the JPEG file, which isn't always known in advance. The computed fraction-of-work-done may jump suddenly (if the library discovers it has overestimated the number of scans) or even decrease (in the opposite case). It is not wise to put great faith in the work estimate.

When using the decompressor's buffered-image mode, the progress monitor work estimate is likely to be completely unhelpful, because the library has no way to know how many output passes will be demanded of it. Currently, the library sets `total_passes` based on the assumption that there will be one more output pass if the input file end hasn't yet been read (`jpeg_input_complete()` isn't TRUE), but no more output passes if the file end has been reached when the output pass is started. This means that `total_passes` will rise as additional output passes are requested. If you have a way of determining the input file size, estimating progress based on the fraction of the file that's been read will probably be more useful than using the library's value.

Memory management

This section covers some key facts about the JPEG library's built-in memory manager. For more info, please read `structure.txt`'s section about the memory manager, and consult the source code if necessary.

All memory and temporary file allocation within the library is done via the memory manager. If necessary, you can replace the "back end" of the memory manager to control allocation yourself (for example, if you don't want the library to use `malloc()` and `free()` for some reason).

Some data is allocated "permanently" and will not be freed until the JPEG object is destroyed. Most data is allocated "per image" and is freed by `jpeg_finish_compress`, `jpeg_finish_decompress`, or `jpeg_abort`. You can call the memory manager yourself to allocate structures that will automatically be freed at these times. Typical code for this is

```
ptr = (*cinfo->mem->alloc_small) ((j_common_ptr) cinfo, JPOOL_IMAGE, size);
```

Use `JPOOL_PERMANENT` to get storage that lasts as long as the JPEG object. Use `alloc_large` instead of `alloc_small` for anything bigger than a few Kbytes. There are also `alloc_sarray` and `alloc_barray` routines that automatically build 2-D sample or block arrays.

The library's minimum space requirements to process an image depend on the image's width, but not on its height, because the library ordinarily works

with "strip" buffers that are as wide as the image but just a few rows high. Some operating modes (eg, two-pass color quantization) require full-image buffers. Such buffers are treated as "virtual arrays": only the current strip need be in memory, and the rest can be swapped out to a temporary file.

If you use the simplest memory manager back end (jmemnobs.c), then no temporary files are used; virtual arrays are simply malloc()'d. Images bigger than memory can be processed only if your system supports virtual memory. The other memory manager back ends support temporary files of various flavors and thus work in machines without virtual memory. They may also be useful on Unix machines if you need to process images that exceed available swap space.

When using temporary files, the library will make the in-memory buffers for its virtual arrays just big enough to stay within a "maximum memory" setting. Your application can set this limit by setting `cinfo->mem->max_memory_to_use` after creating the JPEG object. (Of course, there is still a minimum size for the buffers, so the max-memory setting is effective only if it is bigger than the minimum space needed.) If you allocate any large structures yourself, you must allocate them before `jpeg_start_compress()` or `jpeg_start_decompress()` in order to have them counted against the max memory limit. Also keep in mind that space allocated with `alloc_small()` is ignored, on the assumption that it's too small to be worth worrying about; so a reasonable safety margin should be left when setting `max_memory_to_use`.

If you use the `jmemname.c` or `jmemdos.c` memory manager back end, it is important to clean up the JPEG object properly to ensure that the temporary files get deleted. (This is especially crucial with `jmemdos.c`, where the "temporary files" may be extended-memory segments; if they are not freed, DOS will require a reboot to recover the memory.) Thus, with these memory managers, it's a good idea to provide a signal handler that will trap any early exit from your program. The handler should call either `jpeg_abort()` or `jpeg_destroy()` for any active JPEG objects. A handler is not needed with `jmemnobs.c`, and shouldn't be necessary with `jmemansi.c` or `jmemmac.c` either, since the C library is supposed to take care of deleting files made with `tmpfile()`.

Memory usage

Working memory requirements while performing compression or decompression depend on image dimensions, image characteristics (such as colorspace and JPEG process), and operating mode (application-selected options).

As of v6b, the decompressor requires:

1. About 24K in more-or-less-fixed-size data. This varies a bit depending

- on operating mode and image characteristics (particularly color vs. grayscale), but it doesn't depend on image dimensions.
2. Strip buffers (of size proportional to the image width) for IDCT and upsampling results. The worst case for commonly used sampling factors is about 34 bytes * width in pixels for a color image. A grayscale image only needs about 8 bytes per pixel column.
 3. A full-image DCT coefficient buffer is needed to decode a multi-scan JPEG file (including progressive JPEGs), or whenever you select buffered-image mode. This takes 2 bytes/coefficient. At typical 2x2 sampling, that's 3 bytes per pixel for a color image. Worst case (1x1 sampling) requires 6 bytes/pixel. For grayscale, figure 2 bytes/pixel.
 4. To perform 2-pass color quantization, the decompressor also needs a 128K color lookup table and a full-image pixel buffer (3 bytes/pixel). This does not count any memory allocated by the application, such as a buffer to hold the final output image.

The above figures are valid for 8-bit JPEG data precision and a machine with 32-bit ints. For 12-bit JPEG data, double the size of the strip buffers and quantization pixel buffer. The "fixed-size" data will be somewhat smaller with 16-bit ints, larger with 64-bit ints. Also, CMYK or other unusual color spaces will require different amounts of space.

The full-image coefficient and pixel buffers, if needed at all, do not have to be fully RAM resident; you can have the library use temporary files instead when the total memory usage would exceed a limit you set. (But if your OS supports virtual memory, it's probably better to just use `jemmnobs` and let the OS do the swapping.)

The compressor's memory requirements are similar, except that it has no need for color quantization. Also, it needs a full-image DCT coefficient buffer if Huffman-table optimization is asked for, even if progressive mode is not requested.

If you need more detailed information about memory usage in a particular situation, you can enable the `MEM_STATS` code in `jmemmgr.c`.

Library compile-time options

A number of compile-time options are available by modifying `jmorecfg.h`.

The JPEG standard provides for both the baseline 8-bit DCT process and a 12-bit DCT process. The IJG code supports 12-bit lossy JPEG if you define `BITS_IN_JSAMPLE` as 12 rather than 8. Note that this causes `JSAMPLE` to be

larger than a char, so it affects the surrounding application's image data. The sample applications cjpeg and djpeg can support 12-bit mode only for PPM and GIF file formats; you must disable the other file formats to compile a 12-bit cjpeg or djpeg. (install.txt has more information about that.) At present, a 12-bit library can handle *only* 12-bit images, not both precisions. (If you need to include both 8- and 12-bit libraries in a single application, you could probably do it by defining NEED_SHORT_EXTERNAL_NAMES for just one of the copies. You'd have to access the 8-bit and 12-bit copies from separate application source files. This is untested ... if you try it, we'd like to hear whether it works!)

Note that a 12-bit library always compresses in Huffman optimization mode, in order to generate valid Huffman tables. This is necessary because our default Huffman tables only cover 8-bit data. If you need to output 12-bit files in one pass, you'll have to supply suitable default Huffman tables. You may also want to supply your own DCT quantization tables; the existing quality-scaling code has been developed for 8-bit use, and probably doesn't generate especially good tables for 12-bit.

The maximum number of components (color channels) in the image is determined by MAX_COMPONENTS. The JPEG standard allows up to 255 components, but we expect that few applications will need more than four or so.

On machines with unusual data type sizes, you may be able to improve performance or reduce memory space by tweaking the various typedefs in jmorecfg.h.

In particular, on some RISC CPUs, access to arrays of "short"s is quite slow; consider trading memory for speed by making JCOEF, INT16, and UINT16 be "int" or "unsigned int". UINT8 is also a candidate to become int. You probably don't want to make JSAMPLE be int unless you have lots of memory to burn.

You can reduce the size of the library by compiling out various optional functions. To do this, undefine xxx_SUPPORTED symbols as necessary.

You can also save a few K by not having text error messages in the library; the standard error message table occupies about 5Kb. This is particularly reasonable for embedded applications where there's no good way to display a message anyway. To do this, remove the creation of the message table (jpeg_std_message_table[]) from jerror.c, and alter format_message to do something reasonable without it. You could output the numeric value of the message code number, for example. If you do this, you can also save a couple more K by modifying the TRACEMSn() macros in jerror.h to expand to nothing; you don't need trace capability anyway, right?

Portability considerations

The JPEG library has been written to be extremely portable; the sample applications `cjpeg` and `djpeg` are slightly less so. This section summarizes the design goals in this area. (If you encounter any bugs that cause the library to be less portable than is claimed here, we'd appreciate hearing about them.)

The code works fine on ANSI C, C++, and pre-ANSI C compilers, using any of the popular system include file setups, and some not-so-popular ones too. See `install.txt` for configuration procedures.

The code is not dependent on the exact sizes of the C data types. As distributed, we make the assumptions that

- char is at least 8 bits wide
- short is at least 16 bits wide
- int is at least 16 bits wide
- long is at least 32 bits wide

(These are the minimum requirements of the ANSI C standard.) Wider types will work fine, although memory may be used inefficiently if char is much larger than 8 bits or short is much bigger than 16 bits. The code should work equally well with 16- or 32-bit ints.

In a system where these assumptions are not met, you may be able to make the code work by modifying the typedefs in `jmreconf.h`. However, you will probably have difficulty if int is less than 16 bits wide, since references to plain int abound in the code.

char can be either signed or unsigned, although the code runs faster if an unsigned char type is available. If char is wider than 8 bits, you will need to redefine `JOCTET` and/or provide custom data source/destination managers so that `JOCTET` represents exactly 8 bits of data on external storage.

The JPEG library proper does not assume ASCII representation of characters. But some of the image file I/O modules in `cjpeg/djpeg` do have ASCII dependencies in file-header manipulation; so does `cjpeg's select_file_type()` routine.

The JPEG library does not rely heavily on the C library. In particular, C `stdio` is used only by the data source/destination modules and the error handler, all of which are application-replaceable. (`cjpeg/djpeg` are more heavily dependent on `stdio`.) `malloc` and `free` are called only from the memory manager "back end" module, so you can use a different memory allocator by replacing that one file.

The code generally assumes that C names must be unique in the first 15 characters. However, global function names can be made unique in the first 6 characters by defining `NEED_SHORT_EXTERNAL_NAMES`.

More info about porting the code may be gleaned by reading `jconfig.txt`, `jmorecfg.h`, and `jinclue.h`.

Notes for MS-DOS implementors

The IJG code is designed to work efficiently in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile `cjpeg` or `djpeg` by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model (perhaps 10%-25%), and you should avoid "huge" model if at all possible.

The JPEG library typically needs 2Kb-3Kb of stack space. It will also malloc about 20K-30K of near heap space while executing (and lots of far heap, but that doesn't count in this calculation). This figure will vary depending on selected operating mode, and to a lesser extent on image size. There is also about 5Kb-6Kb of constant data which will be allocated in the near data segment (about 4Kb of this is the error message table). Thus you have perhaps 20K available for other modules' static data and near heap space before you need to go to a larger memory model. The C library's static data will account for several K of this, but that still leaves a good deal for your needs. (If you are tight on space, you could reduce the sizes of the I/O buffers allocated by `jdatasrc.c` and `jdatadst.c`, say from 4K to 1K. Another possibility is to move the error message table to far memory; this should be doable with only localized hacking on `jerror.c`.)

About 2K of the near heap space is "permanent" memory that will not be released until you destroy the JPEG object. This is only an issue if you save a JPEG object between compression or decompression operations.

Far data space may also be a tight resource when you are dealing with large images. The most memory-intensive case is decompression with two-pass color quantization, or single-pass quantization to an externally supplied color map. This requires a 128Kb color lookup table plus strip buffers amounting to about 40 bytes per column for typical sampling ratios (eg, about 25600 bytes for a 640-pixel-wide image). You may not be able to process wide images if you have large data structures of your own.

Of course, all of these concerns vanish if you use a 32-bit flat-memory-model compiler,
such as DJGPP or Watcom C. We highly recommend flat model if you can use it; the JPEG library is significantly faster in flat model.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/libjpeg.txt

No license file was found, but licenses were detected in source scan.

/*

* transupp.h

*

* Copyright (C) 1997-2011, Thomas G. Lane, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains declarations for image transformation routines and

* other utility code used by the jpegtran sample application. These are

* NOT part of the core JPEG library. But we keep these routines separate

* from jpegtran.c to ease the task of maintaining jpegtran-like programs

* that have other user interfaces.

*

* NOTE: all the routines declared here have very specific requirements

* about when they are to be executed during the reading and writing of the

* source and destination files. See the comments in transupp.c, or see

* jpegtran.c for an example of correct usage.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/transupp.h

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; For conditions of distribution and use, see copyright notice in jsimdext.inc

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimxred.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdclrss2-64.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcqmtnmmx.asm

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdmermmx.asm

*

/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2flt-64.asm

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```
/*
 * jmehsys.h
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This include file defines the interface between the system-independent
 * and system-dependent portions of the JPEG memory manager. No other
 * modules need include it. (The system-independent portion is jmemmgr.c;
 * there are several different versions of the system-dependent portion.)
 *
 * This file works as-is for the system-dependent memory managers supplied
 * in the IJG distribution. You may need to modify it if you write a
 * custom memory manager. If system-dependent changes are needed in
 * this file, the best method is to #ifdef them based on a configuration
 * symbol supplied in jconfig.h, as we have done with USE_MSDOS_MEMMGR
 * and USE_MAC_MEMMGR.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmehsys.h
No license file was found, but licenses were detected in source scan.
```

```
/*
 * jdarith.c
 *
 * Developed 1997-2009 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains portable arithmetic entropy decoding routines for JPEG
 * (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
 *
 * Both sequential and progressive modes are supported in this single module.
 *
 * Suspension is not currently supported in this module.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdarith.c
No license file was found, but licenses were detected in source scan.
```

;

```

; jdct.inc - private declarations for forward & reverse DCT subsystems
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
;
; Based on
; x86 SIMD extension for IJG JPEG library
; Copyright (C) 1999-2006, MIYASAKA Masaru.
; For conditions of distribution and use, see copyright notice in jsimdext.inc
;
; [TAB8]

; Each IDCT routine is responsible for range-limiting its results and
; converting them to unsigned form (0..MAXJSAMPLE). The raw outputs could
; be quite far out of range if the input data is corrupt, so a bulletproof
; range-limiting step is required. We use a mask-and-table-lookup method
; to do the combined operations quickly.
;
#define RANGE_MASK (MAXJSAMPLE * 4 + 3) ; 2 bits wider than legal samples

#define ROW(n,b,s) ((b)+(n)*(s))
#define COL(n,b,s) ((b)+(n)*(s)*DCTSIZE)

#define DWBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*sizeof_dword)
#define MMBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*sizeof_mword)
#define
XMMBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*sizeof_xmword)

```

```

; -----

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdct.inc
No license file was found, but licenses were detected in source scan.

```

```

/*

```

```

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*
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*
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* software without specific prior written permission.

```

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* CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
* SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
* INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

```
package org.libjpegturbo.turbojpeg;
```

```
final class TJLoader {  
    static void load() {  
        System.loadLibrary("@TURBOJPEG_DLL_NAME@");  
    }  
};
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJLoader.java.in

No license file was found, but licenses were detected in source scan.

```
/*  
* cdjpeg.c  
*  
* Copyright (C) 1991-1997, Thomas G. Lane.  
* This file is part of the Independent JPEG Group's software.  
* For conditions of distribution and use, see the accompanying README file.  
*  
* This file contains common support routines used by the IJG application  
* programs (cjpeg, djpeg, jpegtran).  
*/
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cdjpeg.c

No license file was found, but licenses were detected in source scan.

```
/*  
* jdmgext.c  
*  
*/
```

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains code for merged upsampling/color conversion.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmrgext.c
No license file was found, but licenses were detected in source scan.

/*

* transupp.c

*

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1997-2011, Thomas G. Lane, Guido Vollbeding.
* Modifications:
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* For conditions of distribution and use, see the accompanying README file.
*
* This file contains image transformation routines and other utility code
* used by the jpegtran sample application. These are NOT part of the core
* JPEG library. But we keep these routines separate from jpegtran.c to
* ease the task of maintaining jpegtran-like programs that have other user
* interfaces.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/transupp.c
No license file was found, but licenses were detected in source scan.

/*

* jerror.h

*

* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the error and message codes for the JPEG library.
* Edit this file to add new codes, or to translate the message strings to
* some other language.
* A set of error-reporting macros are defined too. Some applications using
* the JPEG library may wish to include this file to get the error codes

* and/or the macros.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jerror.h

No license file was found, but licenses were detected in source scan.

/*

* jfdctfst.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a fast, not so accurate integer implementation of the

* forward DCT (Discrete Cosine Transform).

*

* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT

* on each column. Direct algorithms are also available, but they are

* much more complex and seem not to be any faster when reduced to code.

*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for

* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code

* is based directly on figure 4-8 in P&M.

* While an 8-point DCT cannot be done in less

than 11 multiplies, it is

* possible to arrange the computation so that many of the multiplies are

* simple scalings of the final outputs. These multiplies can then be

* folded into the multiplications or divisions by the JPEG quantization

* table entries. The AA&N method leaves only 5 multiplies and 29 adds

* to be done in the DCT itself.

* The primary disadvantage of this method is that with fixed-point math,

* accuracy is lost due to imprecise representation of the scaled

* quantization values. The smaller the quantization table entry, the less

* precise the scaled value, so this implementation does worse with high-

* quality-setting files than with low-quality ones.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctfst.c

No license file was found, but licenses were detected in source scan.

/*

* jcapistd.c

```
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-compression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_compress, it will end up linking in the entire compressor.
* We thus must separate this file from jcapimin.c to avoid linking the
* whole compression library into a transcoder.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcapistd.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* rdswitch.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to process some of cjpeg's more complicated
* command-line switches. Switches processed here are:
* -qtables file Read quantization tables from text file
* -scans file Read scan script from text file
* -quality N[,N,...] Set quality ratings
* -qslots N[,N,...] Set component quantization table selectors
* -sample HxV[,HxV,...] Set component sampling factors
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdswitch.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* djpeg.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
```


* Copyright (C) 2010-2011, 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for the JPEG decompressor.
* It should work on any system with Unix- or MS-DOS-style command lines.
*
* Two different command line styles are permitted, depending on the
* compile-time switch TWO_FILE_COMMANDLINE:
* djpeg [options] inputfile outputfile
* djpeg [options] [inputfile]
* In the second style, output is always to standard output, which you'd
* normally redirect to a file or pipe to some other program. Input is
* either from a named file or from standard input (typically redirected).
* The second style is convenient on Unix but is unhelpful on systems that
* don't support pipes.
Also, you MUST use the first style if your system
* doesn't do binary I/O to stdin/stdout.
* To simplify script writing, the "-outfile" switch is provided. The syntax
* djpeg [options] -outfile outputfile inputfile
* works regardless of which command line style is used.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/djpeg.c
No license file was found, but licenses were detected in source scan.

/*

* jdmainct.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the main buffer controller for decompression.
* The main buffer lies between the JPEG decompressor proper and the
* post-processor; it holds downsampled data in the JPEG colorspace.
*
* Note that this code is bypassed in raw-data mode, since the application
* supplies the equivalent of the main buffer in that case.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmainct.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jchuff.h
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains declarations for Huffman entropy encoding routines
 * that are shared between the sequential encoder (jchuff.c) and the
 * progressive encoder (jcphuff.c). No other modules need to see these.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jchuff.h
```

No license file was found, but licenses were detected in source scan.

```
/*
 * jctrans.c
 *
 * Copyright (C) 1995-1998, Thomas G. Lane.
 * Modified 2000-2009 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains library routines for transcoding compression,
 * that is, writing raw DCT coefficient arrays to an output JPEG file.
 * The routines in jcapimin.c will also be needed by a transcoder.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jctrans.c
```

No license file was found, but licenses were detected in source scan.

```
;
; jcolsamp.inc - private declarations for color conversion & up/downsampling
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
;
; Based on
; x86 SIMD extension for IJG JPEG library
; Copyright (C) 1999-2006, MIYASAKA Masaru.
; For conditions of distribution and use, see copyright notice in jsimdext.inc
;
; [TAB8]
```

;-----

; pseudo-resisters to make ordering of RGB configurable

;

```
%if RGB_RED == 0
%define mmA mm0
%define mmB mm1
%define xmmA xmm0
%define xmmB xmm1
%elif RGB_GREEN == 0
%define mmA mm2
%define mmB mm3
%define xmmA xmm2
%define xmmB xmm3
%elif RGB_BLUE == 0
%define mmA mm4
%define mmB mm5
%define xmmA xmm4
%define xmmB xmm5
%else
%define mmA mm6
%define mmB mm7
%define xmmA xmm6
%define xmmB xmm7
%endif
```

```
%if RGB_RED == 1
%define mmC mm0
%define mmD mm1
%define xmmC xmm0
%define xmmD xmm1
%elif RGB_GREEN
== 1
%define mmC mm2
%define mmD mm3
%define xmmC xmm2
%define xmmD xmm3
%elif RGB_BLUE == 1
%define mmC mm4
%define mmD mm5
%define xmmC xmm4
%define xmmD xmm5
%else
%define mmC mm6
%define mmD mm7
%define xmmC xmm6
%define xmmD xmm7
```

```
%endif

%if RGB_RED == 2
%define mmE mm0
%define mmF mm1
%define xmmE xmm0
%define xmmF xmm1
%elif RGB_GREEN == 2
%define mmE mm2
%define mmF mm3
%define xmmE xmm2
%define xmmF xmm3
%elif RGB_BLUE == 2
%define mmE mm4
%define mmF mm5
%define xmmE xmm4
%define xmmF xmm5
%else
%define mmE mm6
%define mmF mm7
%define xmmE xmm6
%define xmmF xmm7
%endif
```

```
%if RGB_RED == 3
%define mmG mm0
%define mmH mm1
%define xmmG xmm0
%define xmmH xmm1
%elif RGB_GREEN == 3
%define mmG mm2
%define mmH mm3
%define xmmG xmm2
%define xmmH xmm3
%elif RGB_BLUE == 3
%define mmG mm4
%define mmH mm5
%define xmmG xmm4
%define xmmH xmm5
%else
%define mmG mm6
%define mmH mm7
%define xmmG xmm6
%define xmmH xmm7
%endif
```

```
;-----
```

Found

in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcolsamp.inc
No license file was found, but licenses were detected in source scan.

/*

* jtparam.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2003-2008 by Guido Vollbeding.

* Modifications:

* Copyright (C) 2009-2011, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains optional default-setting code for the JPEG compressor.

* Applications do not have to use this file, but those that don't use it

* must know a lot more about the innards of the JPEG code.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jtparam.c
No license file was found, but licenses were detected in source scan.

/*

* jdmaster.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2002-2009 by Guido Vollbeding.

* Modifications:

* Copyright (C) 2009-2011, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains master control logic for the JPEG decompressor.

* These routines are concerned with selecting the modules to be executed

* and with determining the number of passes and the work to be done in each

* pass.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmaster.c
No license file was found, but licenses were detected in source scan.

/*

```
* jdatasrc.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2011 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains decompression data source routines for the case of
* reading JPEG data from memory or from a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different source manager.
* IMPORTANT: we assume that fread() will correctly transcribe an array of
* JOCTETs from 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UW7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatasrc.c
No license file was found, but licenses were detected in source scan.
```

```
/*
* jQuery JavaScript Library v1.3.2
* http://jquery.com/
*
* Copyright (c) 2009 John Resig
* Dual licensed under the MIT and GPL licenses.
* http://docs.jquery.com/License
*
* Date: 2009-02-19 17:34:21 -0500 (Thu, 19 Feb 2009)
* Revision: 6246
*/
```

```
/*
* Sizzle CSS Selector Engine - v0.9.3
* Copyright 2009, The Dojo Foundation
* Released under the MIT, BSD, and GPL Licenses.
* More information: http://sizzlejs.com/
*/
```

```
/*
* jQuery UI 1.7.2
*
* Copyright (c) 2009 AUTHORS.txt (http://jqueryui.com/about)
* Dual licensed under the MIT (MIT-LICENSE.txt)
* and GPL (GPL-LICENSE.txt) licenses.
*
* http://docs.jquery.com/UI
```

```
*/
/**
 * jQuery.ScrollTo - Easy element scrolling using jQuery.
 * Copyright (c) 2008 Ariel Flesler - aflesler(at)gmail(dot)com
 * Licensed under GPL license (http://www.opensource.org/licenses/gpl-license.php).
 * Date: 2/8/2008
 * @author Ariel Flesler
 * @version 1.3.2
 */
```

Found

in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/doc/html/jquery.js
No license file was found, but licenses were detected in source scan.
```

```
/*
 * jdatadst-tj.c
 *
 * This file was part of the Independent JPEG Group's software:
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2009-2012 by Guido Vollbeding.
 * Modifications:
 * Copyright (C) 2011, D. R. Commander.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains compression data destination routines for the case of
 * emitting JPEG data to memory or to a file (or any stdio stream).
 * While these routines are sufficient for most applications,
 * some will want to use a different destination manager.
 * IMPORTANT: we assume that fwrite() will correctly transcribe an array of
 * JOCTETs into 8-bit-wide elements on external storage. If char is wider
 * than 8 bits on your machine, you may need to do some tweaking.
 */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatadst-tj.c
No license file was found, but licenses were detected in source scan.
```

```
/*
 * cdjpeg.h
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains common declarations for the sample applications
```

* cjpeg and djpeg. It is NOT used by the core JPEG library.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cdjpeg.h

No license file was found, but licenses were detected in source scan.

/*

* jdhuiff.h

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modifications:

* Copyright (C) 2010-2011, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains declarations for Huffman entropy decoding routines

* that are shared between the sequential decoder (jdhuiff.c) and the

* progressive decoder (jdpuff.c). No other modules need to see these.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdhuiff.h

No license file was found, but licenses were detected in source scan.

/*

* jdsample.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modifications:

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Copyright (C) 2010, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains upsampling routines.

*

* Upsampling input data is counted in "row groups". A row group

* is defined to be (v_samp_factor * DCT_scaled_size / min_DCT_scaled_size)

* sample rows of each component. Upsampling will normally produce

* max_v_samp_factor pixel rows from each row group (but this could vary

* if the upsampler is applying a scale factor of its own).

*

* An excellent reference for image resampling is

* Digital Image Warping, George Wolberg, 1990.

* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdsample.c
No license file was found, but licenses were detected in source scan.

/*

* rdcolmap.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file implements djpeg's "-map file" switch. It reads a source image

* and constructs a colormap to be supplied to the JPEG decompressor.

*

* Currently, these file formats are supported for the map file:

* GIF: the contents of the GIF's global colormap are used.

* PPM (either text or raw flavor): the entire file is read and

* each unique pixel value is entered in the map.

* Note that reading a large PPM file will be horrendously slow.

* Typically, a PPM-format map file should contain just one pixel

* of each desired color. Such a file can be extracted from an

* ordinary image PPM file with ppmtomap(1).

*

* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not

* currently implemented.

*/

/* Portions of this code are based on the PBMPLUS library, which is:

**

** Copyright (C) 1988 by Jef Poskanzer.

**

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** documentation for any purpose and without fee is hereby granted, provided

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** copyright notice and this permission notice appear in supporting

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** implied warranty.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdcolmap.c
No license file was found, but licenses were detected in source scan.

/*

* jsimd_arm.c

*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2009-2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
* This file contains the interface between the "normal" portions
* of the library and the SIMD implementations when running on
* ARM architecture.
*
* Based on the stubs from 'jsimd_none.c'
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_arm.c
No license file was found, but licenses were detected in source scan.

/*
* Copyright (C)2011 D. R. Commander. All Rights Reserved.
*
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* modification, are permitted provided that the following conditions are met:
*
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* - Redistributions in binary form must reproduce the above copyright notice,
* this list of conditions and the following disclaimer in the documentation
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* - Neither the name of the libjpeg-turbo Project nor the names of its
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*
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* LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
* CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
* SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
* INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

Found in path(s):

- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/bmp.h
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJScalingFactor.java
- *
- /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcstest.c
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjutil.h
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/bmp.c
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJCustomFilter.java
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJTransform.java
- *
- /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJTransformer.java
- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjutil.c

No license file was found, but licenses were detected in source scan.

/*

* jpegint.h

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 1997-2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file provides common declarations for the various JPEG modules.

* These declarations are considered internal to the JPEG library; most

* applications using the library shouldn't need to include this file.

*/

Found in path(s):

- * /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegint.h

No license file was found, but licenses were detected in source scan.

/*

* jquant1.c

*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009, D. R. Commander
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains 1-pass color quantization (color mapping) routines.
* These routines provide mapping to a fixed color map using equally spaced
* color values. Optional Floyd-Steinberg or ordered dithering is available.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UW7iFaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jquant1.c
No license file was found, but licenses were detected in source scan.

1.2.90 (1.3 beta1)

=====

[1] Added support for additional scaling factors (3/8, 5/8, 3/4, 7/8, 9/8, 5/4, 11/8, 3/2, 13/8, 7/4, 15/8, and 2) when decompressing. Note that the IDCT will not be SIMD-accelerated when using any of these new scaling factors.

[2] The TurboJPEG dynamic library is now versioned. It was not strictly necessary to do so, because TurboJPEG uses versioned symbols, and if a function changes in an ABI-incompatible way, that function is renamed and a legacy function is provided to maintain backward compatibility. However, certain Linux distro maintainers will blindly reject any library that is not versioned, so this was an attempt to make them happy.

[3] Extended the TurboJPEG Java API so that it can be used to compress a JPEG image from and decompress a JPEG image to an arbitrary position in a large image buffer.

[4] The `tjDecompressToYUV()` function now supports the `TJFLAG_FASTDCT` flag.

[5] The 32-bit supplementary package for amd64 Debian systems now provides symlinks in `/usr/lib/i386-linux-gnu` for the TurboJPEG libraries in `/usr/lib32`. This allows those libraries to be used on MultiArch-compatible systems (such as Ubuntu 11 and later) without setting the linker path.

[6] The TurboJPEG Java wrapper should now find the JNI library on Mac systems without having to pass `-Djava.library.path=/usr/lib` to java.

[7] `TJBench` has been ported to Java to provide a convenient way of validating the performance of the TurboJPEG Java API. It can be run with

'java -cp turbojpeg.jar TJBench'.

[8] cjpeg can now be used to generate JPEG files with the RGB colorspace (feature ported from jpeg-8d.)

[9] The width and height in the -crop argument passed to jpegtran can now be suffixed with "f" to indicate that, when the upper left corner of the cropping region is automatically moved to the nearest iMCU boundary, the bottom right corner should be moved by the same amount. In other words, this feature causes jpegtran to strictly honor the specified width/height rather than the specified bottom right corner (feature ported from jpeg-8d.)

[10] JPEG files using the RGB colorspace can now be decompressed into grayscale images (feature ported from jpeg-8d.)

[11] Fixed a regression caused by 1.2.1[7] whereby the build would fail with multiple "Mismatch in operand sizes" errors when attempting to build the x86 SIMD code with NASM 0.98.

[12] The in-memory source/destination managers (jpeg_mem_src() and jpeg_mem_dest()) are now included by default when building libjpeg-turbo with libjpeg v6b or v7 emulation, so that programs can take advantage of these functions without requiring the use of the backward-incompatible libjpeg v8 ABI. The "age number" of the libjpeg-turbo library on Un*x systems has been incremented by 1 to reflect this. You can disable this feature with a configure/CMake switch in order to retain strict API/ABI compatibility with the libjpeg v6b or v7 API/ABI (or with previous versions of libjpeg-turbo.) See README-turbo.txt for more details.

[13] Added ARM v7s architecture to libjpeg.a and libturbojpeg.a in the official libjpeg-turbo binary package for OS X, so that those libraries can be used to build applications that leverage the faster CPUs in the iPhone 5 and iPad 4.

1.2.1

=====

[1] Creating or decoding a JPEG file that uses the RGB colorspace should now properly work when the input or output colorspace is one of the libjpeg-turbo colorspace extensions.

[2] When libjpeg-turbo was built without SIMD support and merged (non-fancy) upsampling was used along with an alpha-enabled colorspace during decompression, the unused byte of the decompressed pixels was not being set to 0xFF. This has been fixed. TJUnitTest has also been extended to test for the correct behavior of the colorspace extensions when merged upsampling is used.

[3] Fixed a bug whereby the libjpeg-turbo SSE2 SIMD code would not preserve the upper 64 bits of xmm6 and xmm7 on Win64 platforms, which violated the Win64 calling conventions.

[4] Fixed a regression caused by 1.2.0[6] whereby decompressing corrupt JPEG images (specifically, images in which the component count was erroneously set to a large value) would cause libjpeg-turbo to segfault.

[5] Worked around a severe performance issue with "Bobcat" (AMD Embedded APU) processors. The MASKMOVDQU instruction, which was used by the libjpeg-turbo SSE2 SIMD code, is apparently implemented in microcode on AMD processors, and it is painfully slow on Bobcat processors in particular. Eliminating the use of this instruction improved performance by an order of magnitude on Bobcat processors and by a small amount (typically 5%) on AMD desktop processors.

[6] Added SIMD acceleration for performing 4:2:2 upsampling on NEON-capable ARM platforms. This speeds up the decompression of 4:2:2 JPEGs by 20-25% on such platforms.

[7] Fixed a regression caused by 1.2.0[2] whereby, on Linux/x86 platforms running the 32-bit SSE2 SIMD code in libjpeg-turbo, decompressing a 4:2:0 or 4:2:2 JPEG image into a 32-bit (RGBX, BGRX, etc.) buffer without using fancy upsampling would produce several incorrect columns of pixels at the right-hand side of the output image if each row in the output image was not evenly divisible by 16 bytes.

[8] Fixed an issue whereby attempting to build the SIMD extensions with Xcode 4.3 on OS X platforms would cause NASM to return numerous errors of the form "'%define' expects a macro identifier".

[9] Added flags to the TurboJPEG API that allow the caller to force the use of either the fast or the accurate DCT/IDCT algorithms in the underlying codec.

1.2.0

=====

[1] Fixed build issue with YASM on Unix systems (the libjpeg-turbo build system was not adding the current directory to the assembler include path, so YASM was not able to find jsimdcfg.inc.)

[2] Fixed out-of-bounds read in SSE2 SIMD code that occurred when decompressing a JPEG image to a bitmap

buffer whose size was not a multiple of 16 bytes.

This was more of an annoyance than an actual bug, since it did not cause any

actual run-time problems, but the issue showed up when running libjpeg-turbo in valgrind. See <http://crbug.com/72399> for more information.

[3] Added a compile-time macro (`LIBJPEG_TURBO_VERSION`) that can be used to check the version of libjpeg-turbo against which an application was compiled.

[4] Added new RGBA/BGRA/ABGR/ARGB colorspace extension constants (libjpeg API) and pixel formats (TurboJPEG API), which allow applications to specify that, when decompressing to a 4-component RGB buffer, the unused byte should be set to `0xFF` so that it can be interpreted as an opaque alpha channel.

[5] Fixed regression issue whereby DevIL failed to build against libjpeg-turbo because libjpeg-turbo's distributed version of `jconfig.h` contained an `INLINE` macro, which conflicted with a similar macro in DevIL. This macro is used only internally when building libjpeg-turbo, so it was moved into `config.h`.

[6] libjpeg-turbo will now correctly decompress erroneous CMYK/YCCK JPEGs whose K component is assigned a component ID of 1 instead of 4. Although these files are in violation of the spec, other JPEG implementations handle them correctly.

[7] Added ARM v6 and ARM v7 architectures to `libjpeg.a` and `libturbojpeg.a` in the official libjpeg-turbo binary package for OS X, so that those libraries can be used to build both OS X and iOS applications.

1.1.90 (1.2 beta1)

=====

[1] Added a Java wrapper for the TurboJPEG API. See `java/README` for more details.

[2] The TurboJPEG API can now be used to scale down images during decompression.

[3] Added SIMD routines for RGB-to-grayscale color conversion, which significantly improves the performance of grayscale JPEG compression from an RGB source image.

[4] Improved the performance of the C color conversion routines, which are used on platforms for which SIMD acceleration is not available.

[5] Added a function to the TurboJPEG API that performs lossless transforms. This function is implemented using the same back end as `jpegtran`, but it performs transcoding entirely in memory and allows multiple transforms and/or crop operations to be batched together, so the source coefficients only need to

be read once. This is useful when generating image tiles from a single source JPEG.

[6] Added tests for the new TurboJPEG scaled decompression and lossless transform features to tjbench (the TurboJPEG benchmark, formerly called "jpgtest".)

[7] Added support for 4:4:0 (transposed 4:2:2) subsampling in TurboJPEG, which was necessary in order for it to read 4:2:2 JPEG files that had been losslessly transposed or rotated 90 degrees.

[8] All legacy VirtualGL code has been re-factored, and this has allowed libjpeg-turbo, in its entirety, to be re-licensed under a BSD-style license.

[9] libjpeg-turbo can now be built with YASM.

[10] Added SIMD acceleration for ARM Linux and iOS platforms that support NEON instructions.

[11] Refactored the TurboJPEG C API and documented it using Doxygen. The TurboJPEG 1.2 API uses pixel formats to define the size and component order of the uncompressed source/destination images, and it includes a more efficient version of TJBUFFSIZE() that computes a worst-case JPEG size based on the level of chrominance subsampling. The refactored implementation of the TurboJPEG API now uses the libjpeg memory source and destination managers, which allows the TurboJPEG compressor to grow the JPEG buffer as necessary.

[12] Eliminated errors in the output of jpegtran on Windows that occurred when the application was invoked using I/O redirection (jpegtran <input.jpg >output.jpg).

[13] The inclusion of libjpeg v7 and v8 emulation as well as arithmetic coding support in libjpeg-turbo v1.1.0 introduced several new error constants in jerror.h, and these were mistakenly enabled for all emulation modes, causing the error enum in libjpeg-turbo to sometimes have different values than the same enum in libjpeg. This represents an ABI incompatibility, and it caused problems with rare applications that took specific action based on a particular error value. The fix was to include the new error constants conditionally based on whether libjpeg v7 or v8 emulation was enabled.

[14] Fixed an issue whereby Windows applications that used libjpeg-turbo would fail to compile if the Windows system headers were included before jpeglib.h. This issue was caused by a conflict in the definition of the INT32 type.

[15] Fixed 32-bit supplementary package for amd64 Debian systems, which was broken by enhancements to the packaging system in 1.1.

[16] When decompressing a JPEG image using an output colorspace of JCS_EXT_RGBX, JCS_EXT_BGRX, JCS_EXT_XBGR, or JCS_EXT_XRGB, libjpeg-turbo will now set the unused byte to 0xFF, which allows applications to interpret that byte as an alpha channel (0xFF = opaque).

1.1.1

=====

[1] Fixed a 1-pixel error in row 0, column 21 of the luminance plane generated by tjEncodeYUV().

[2] libjpeg-turbo's accelerated Huffman decoder previously ignored unexpected markers found in the middle of the JPEG data stream during decompression. It will now hand off decoding of a particular block to the unaccelerated Huffman decoder if an unexpected marker is found, so that the unaccelerated Huffman decoder can generate an appropriate warning.

[3] Older versions of MinGW64 prefixed symbol names with underscores by default, which differed from the behavior of 64-bit Visual C++. MinGW64 1.0 has adopted the behavior of 64-bit Visual C++ as the default, so to accommodate this, the libjpeg-turbo SIMD function names are no longer prefixed with an underscore when building with MinGW64. This means that, when building libjpeg-turbo with older versions of MinGW64, you will now have to add `-fno-leading-underscore` to the CFLAGS.

[4] Fixed a regression bug in the NSIS script that caused the Windows installer build to fail when using the Visual Studio IDE.

[5] Fixed a bug in `jpeg_read_coefficients()` whereby it would not initialize `cinfo->image_width` and `cinfo->image_height` if libjpeg v7 or v8 emulation was enabled. This specifically caused the `jpegoptim` program to fail if it was linked against a version of libjpeg-turbo that was built with libjpeg v7 or v8 emulation.

[6] Eliminated excessive I/O overhead that occurred when reading BMP files in `cjpeg`.

[7] Eliminated errors in the output of `cjpeg` on Windows that occurred when the application was invoked using I/O redirection (`cjpeg <inputfile >output.jpg`).

1.1.0

=====

[1] The algorithm used by the SIMD quantization function cannot produce correct results when the JPEG quality is ≥ 98 and the fast integer forward DCT is used. Thus, the non-SIMD quantization function is now used for those cases, and libjpeg-turbo should now produce identical output to libjpeg v6b in all cases.

[2] Despite the above, the fast integer forward DCT still degrades somewhat for JPEG

qualities greater than 95, so the TurboJPEG wrapper will now automatically use the slow integer forward DCT when generating JPEG images of quality 96 or greater. This reduces compression performance by as much as 15% for these high-quality images but is necessary to ensure that the images are perceptually lossless. It also ensures that the library can avoid the performance pitfall created by [1].

[3] Ported jpgtest.cxx to pure C to avoid the need for a C++ compiler.

[4] Fixed visual artifacts in grayscale JPEG compression caused by a typo in the RGB-to-luminance lookup tables.

[5] The Windows distribution packages now include the libjpeg run-time programs (cjpeg, etc.)

[6] All packages now include jpgtest.

[7] The TurboJPEG dynamic library now uses versioned symbols.

[8] Added two new TurboJPEG API functions, tjEncodeYUV() and tjDecompressToYUV(), to replace the somewhat hackish TJ_YUV flag.

1.0.90 (1.1 beta1)

=====

[1] Added emulation of the libjpeg v7 and v8 APIs and ABIs. See

README-turbo.txt for more details. This feature was sponsored by CamTrace SAS.

[2] Created a new CMake-based build system for the Visual C++ and MinGW builds.

[3] Grayscale bitmaps can now be compressed from/decompressed to using the TurboJPEG API.

[4] jpgtest can now be used to test decompression performance with existing JPEG images.

[5] If the default install prefix (/opt/libjpeg-turbo) is used, then 'make install' now creates /opt/libjpeg-turbo/lib32 and

/opt/libjpeg-turbo/lib64 sym links to duplicate the behavior of the binary packages.

[6] All symbols in the libjpeg-turbo dynamic library are now versioned, even when the library is built with libjpeg v6b emulation.

[7] Added arithmetic encoding and decoding support (can be disabled with configure or CMake options)

[8] Added a TJ_YUV flag to the TurboJPEG API, which causes both the compressor and decompressor to output planar YUV images.

[9] Added an extended version of tjDecompressHeader() to the TurboJPEG API, which allows the caller to determine the type of subsampling used in a JPEG image.

[10] Added further protections against invalid Huffman codes.

1.0.1

=====

[1] The Huffman decoder will now handle erroneous Huffman codes (for instance, from a corrupt JPEG image.) Previously, these would cause libjpeg-turbo to crash under certain circumstances.

[2] Fixed typo in SIMD dispatch routines that was causing 4:2:2 upsampling to be used instead of 4:2:0 when decompressing JPEG images using SSE2 code.

[3] configure script will now automatically determine whether the INCOMPLETE_TYPES_BROKEN macro should be defined.

1.0.0

=====

[1] 2983700: Further FreeBSD build tweaks (no longer necessary to specify --host when configuring on a 64-bit system)

[2] Created symlinks in the Unix/Linux packages so that the TurboJPEG include file can always be found in /opt/libjpeg-turbo/include, the 32-bit static libraries can always be found in /opt/libjpeg-turbo/lib32, and the 64-bit static libraries can always be found in /opt/libjpeg-turbo/lib64.

[3] The Unix/Linux distribution packages now include the libjpeg run-time programs (cjpeg, etc.) and man pages.

[4] Created a 32-bit supplementary package for amd64 Debian systems, which contains just the 32-bit libjpeg-turbo libraries.

[5] Moved the libraries from */lib32 to */lib in the i386 Debian package.

[6] Include distribution package for Cygwin

[7] No longer necessary to specify --without-simd on non-x86 architectures, and unit tests now work on those architectures.

0.0.93

=====

[1] 2982659, Fixed x86-64 build on FreeBSD systems

[2] 2988188: Added support for Windows 64-bit systems

0.0.91

=====

[1] Added documentation to .deb packages

[2] 2968313: Fixed data corruption issues when decompressing large JPEG images and/or using buffered I/O with the libjpeg-turbo decompressor

0.0.90

=====

Initial release

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/ChangeLog.txt
No license file was found, but licenses were detected in source scan.

/*

* jconfig.txt

*

* Copyright (C) 1991-1994, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file documents the configuration options that are required to

* customize the JPEG software for a particular system.

```

*
* The actual configuration options for a particular installation are stored
* in jconfig.h. On many machines, jconfig.h can be generated automatically
* or copied from one of the "canned" jconfig files that we supply. But if
* you need to generate a jconfig.h file by hand, this file tells you how.
*
* DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.
* EDIT A COPY NAMED JCONFIG.H.
*/

/*
* These symbols indicate the properties of your machine or compiler.
* #define the symbol if yes, #undef it if no.
*/

/* Does your compiler support function prototypes?
* (If not,
* you also need to use ansi2knr, see install.txt)
*/
#define HAVE_PROTOTYPES

/* Does your compiler support the declaration "unsigned char" ?
* How about "unsigned short" ?
*/
#define HAVE_UNSIGNED_CHAR
#define HAVE_UNSIGNED_SHORT

/* Define "void" as "char" if your compiler doesn't know about type void.
* NOTE: be sure to define void such that "void *" represents the most general
* pointer type, e.g., that returned by malloc().
*/
/* #define void char */

/* Define "const" as empty if your compiler doesn't know the "const" keyword.
*/
/* #define const */

/* Define this if an ordinary "char" type is unsigned.
* If you're not sure, leaving it undefined will work at some cost in speed.
* If you defined HAVE_UNSIGNED_CHAR then the speed difference is minimal.
*/
#undef CHAR_IS_UNSIGNED

/* Define this if your system has an ANSI-conforming <stddef.h> file.
*/
#define HAVE_STDDEF_H

```

```

/* Define this if your system has an ANSI-conforming <stdlib.h> file.
*/
#define HAVE_STDLIB_H

/*
Define this if your system does not have an ANSI/SysV <string.h>,
* but does have a BSD-style <strings.h>.
*/
#undef NEED_BSD_STRINGS

/* Define this if your system does not provide typedef size_t in any of the
* ANSI-standard places (stddef.h, stdlib.h, or stdio.h), but places it in
* <sys/types.h> instead.
*/
#undef NEED_SYS_TYPES_H

/* For 80x86 machines, you need to define NEED_FAR_POINTERS,
* unless you are using a large-data memory model or 80386 flat-memory mode.
* On less brain-damaged CPUs this symbol must not be defined.
* (Defining this symbol causes large data structures to be referenced through
* "far" pointers and to be allocated with a special version of malloc.)
*/
#undef NEED_FAR_POINTERS

/* Define this if your linker needs global names to be unique in less
* than the first 15 characters.
*/
#undef NEED_SHORT_EXTERNAL_NAMES

/* Although a real ANSI C compiler can deal perfectly well with pointers to
* unspecified structures (see "incomplete types" in the
spec), a few pre-ANSI
* and pseudo-ANSI compilers get confused. To keep one of these bozos happy,
* define INCOMPLETE_TYPES_BROKEN. This is not recommended unless you
* actually get "missing structure definition" warnings or errors while
* compiling the JPEG code.
*/
#undef INCOMPLETE_TYPES_BROKEN

/* Define "boolean" as unsigned char, not int, on Windows systems.
*/
#ifdef _WIN32
#ifndef __RPCNDR_H__ /* don't conflict if rpcndr.h already read */
typedef unsigned char boolean;
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
#endif

```

```

/*
* The following options affect code selection within the JPEG library,
* but they don't need to be visible to applications using the library.
* To minimize application namespace pollution, the symbols won't be
* defined unless JPEG_INTERNALS has been defined.
*/

#ifndef JPEG_INTERNALS

/* Define this if your compiler implements ">>" on signed values as a logical
* (unsigned) shift; leave it undefined if ">>" is a
* signed (arithmetic) shift,
* which is the normal and rational definition.
*/
#undef RIGHT_SHIFT_IS_UNSIGNED

#endif /* JPEG_INTERNALS */

/*
* The remaining options do not affect the JPEG library proper,
* but only the sample applications cjpeg/djpeg (see cjpeg.c, djpeg.c).
* Other applications can ignore these.
*/

#ifndef JPEG_CJPEG_DJPEG

/* These defines indicate which image (non-JPEG) file formats are allowed. */

#define BMP_SUPPORTED /* BMP image file format */
#define GIF_SUPPORTED /* GIF image file format */
#define PPM_SUPPORTED /* PBMPLUS PPM/PGM image file format */
#undef RLE_SUPPORTED /* Utah RLE image file format */
#define TARGA_SUPPORTED /* Targa image file format */

/* Define this if you want to name both input and output files on the command
* line, rather than using stdout and optionally stdin. You MUST do this if
* your system can't cope with binary I/O to stdin/stdout. See comments at
* head of cjpeg.c or djpeg.c.
*/
#undef TWO_FILE_COMMANDLINE

/*
* Define this if your system needs explicit cleanup of temporary files.
* This is crucial under MS-DOS, where the temporary "files" may be areas
* of extended memory; on most other systems it's not as important.

```

```
*/
#undef NEED_SIGNAL_CATCHER

/* By default, we open image files with fopen(...,"rb") or fopen(...,"wb").
* This is necessary on systems that distinguish text files from binary files,
* and is harmless on most systems that don't. If you have one of the rare
* systems that complains about the "b" spec, define this symbol.
*/
#undef DONT_USE_B_MODE

/* Define this if you want percent-done progress reports from cjpeg/djpeg.
*/
#undef PROGRESS_REPORT

#endif /* JPEG_CJPEG_DJPEG */
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jconfig.txt
No license file was found, but licenses were detected in source scan.
```

```
/*
* jerror.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains simple error-reporting and trace-message routines.
* These are suitable for Unix-like systems and others where writing to
* stderr is the right thing to do. Many applications will want to replace
* some or all of these routines.
*
* If you define USE_WINDOWS_MESSAGEBOX in jconfig.h or in the makefile,
* you get a Windows-specific hack to display error messages in a dialog box.
* It ain't much, but it beats dropping error messages into the bit bucket,
* which is what happens to output to stderr under most Windows C compilers.
*
* These routines are used by both the compression and decompression code.
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jerror.c
No license file was found, but licenses were detected in source scan.
```

License: IJG

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo.spec

No license file was found, but licenses were detected in source scan.

/*

* jcsample.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains downsampling routines.

*

* Downsampling input data is counted in "row groups". A row group

* is defined to be max_v_samp_factor pixel rows of each component,

* from which the downsampler produces v_samp_factor sample rows.

* A single row group is processed in each call to the downsampler module.

*

* The downsampler is responsible for edge-expansion of its output data

* to fill an integral number of DCT blocks horizontally. The source buffer

* may be modified if it is helpful for this purpose (the source buffer is

* allocated wide enough to correspond to the desired output width).

* The caller (the prep controller) is

responsible for vertical padding.

*

* The downsampler may request "context rows" by setting need_context_rows

* during startup. In this case, the input arrays will contain at least

* one row group's worth of pixels above and below the passed-in data;

* the caller will create dummy rows at image top and bottom by replicating

* the first or last real pixel row.

*

* An excellent reference for image resampling is

* Digital Image Warping, George Wolberg, 1990.

* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.

*

* The downsampling algorithm used here is a simple average of the source

* pixels covered by the output pixel. The hi-falutin sampling literature

* refers to this as a "box filter". In general the characteristics of a box

* filter are not very good, but for the specific cases we normally use (1:1

* and 2:1 ratios) the box is equivalent to a "triangle filter" which is not

* nearly so bad. If you intend to use other sampling ratios,

you'd be well

* advised to improve this code.

*

* A simple input-smoothing capability is provided. This is mainly intended

* for cleaning up color-dithered GIF input files (if you find it inadequate,
* we suggest using an external filtering program such as pnmconvol). When
* enabled, each input pixel P is replaced by a weighted sum of itself and its
* eight neighbors. P's weight is 1-8*SF and each neighbor's weight is SF,
* where SF = (smoothing_factor / 1024).
* Currently, smoothing is only supported for 2h2v sampling factors.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcsample.c
No license file was found, but licenses were detected in source scan.

// Natural Docs is licensed under the GPL.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/doc/html/search/search.js
No license file was found, but licenses were detected in source scan.

/*

* jdinput.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modifications:

* Copyright (C) 2010, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains input control logic for the JPEG decompressor.

* These routines are concerned with controlling the decompressor's input

* processing (marker reading and coefficient decoding). The actual input

* reading is done in jdmarker.c, jdhuuff.c, and jdphuff.c.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdinput.c
No license file was found, but licenses were detected in source scan.

/*

* wrgif.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

```

* This file contains routines to write output images in GIF format.
*
*****
* NOTE: to avoid entanglements with Unisys' patent on LZW compression, *
* this code has been modified to output "uncompressed GIF" files. *
* There is no trace of the LZW algorithm in this file. *
*****
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*/
/*
* This code is loosely based on ppmtogif from the PBMPLUS distribution
* of Feb. 1991. That file
contains the following copyright notice:
* Based on GIFENCODE by David Rowley <mgardi@watdscu.waterloo.edu>.
* Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.
* Copyright (C) 1989 by Jef Poskanzer.
* Permission to use, copy, modify, and distribute this software and its
* documentation for any purpose and without fee is hereby granted, provided
* that the above copyright notice appear in all copies and that both that
* copyright notice and this permission notice appear in supporting
* documentation. This software is provided "as is" without express or
* implied warranty.
*
* We are also required to state that
* "The Graphics Interchange Format(c) is the Copyright property of
* CompuServe Incorporated. GIF(sm) is a Service Mark property of
* CompuServe Incorporated."
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrgif.c
No license file was found, but licenses were detected in source scan.

/*
* jmemmgr.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the JPEG system-independent memory management
* routines. This code is usable across a wide variety of machines; most
* of the system dependencies have been isolated in a separate file.
* The major functions provided here are:

```

* * pool-based allocation and freeing of memory;
* * policy decisions about how to divide available memory among the
* virtual arrays;
* * control logic for swapping virtual arrays between main memory and
* backing storage.
* The separate system-dependent file provides the actual backing-storage
* access code, and it contains the policy decision about how much total
* main memory to use.
* This file is system-dependent in the sense that some of
its functions
* are unnecessary in some systems. For example, if there is enough virtual
* memory so that backing storage will never be used, much of the virtual
* array control logic could be removed. (Of course, if you have that much
* memory then you shouldn't care about a little bit of unused code...)
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmemmgr.c
No license file was found, but licenses were detected in source scan.

/*

* jchuff.c

*

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009-2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy encoding routines.
*
* Much of the complexity here has to do with supporting output suspension.
* If the data destination module demands suspension, we want to be able to
* back up to the start of the current MCU. To do this, we copy state
* variables into local working storage, and update them back to the
* permanent JPEG objects only upon successful completion of an MCU.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jchuff.c
No license file was found, but licenses were detected in source scan.

/*

* jquant2.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains 2-pass color quantization (color mapping) routines.
* These routines provide selection of a custom color map for an image,
* followed by mapping of the image to that color map, with optional
* Floyd-Steinberg dithering.
* It is also possible to use just the second pass to map to an arbitrary
* externally-given color map.
*
* Note: ordered dithering is not supported, since there isn't any fast
* way to compute intercolor distances; it's unclear that ordered dither's
* fundamental assumptions even hold with an irregularly spaced color map.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jquant2.c
No license file was found, but licenses were detected in source scan.

/*

* jdct.h

*

* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This include file contains common declarations for the forward and
* inverse DCT modules. These declarations are private to the DCT managers
* (jcdctmgr.c, jdctmgr.c) and the individual DCT algorithms.
* The individual DCT algorithms are kept in separate files to ease
* machine-dependent tuning (e.g., assembly coding).
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdct.h
No license file was found, but licenses were detected in source scan.

/*

* jpegcomp.h

*

* Copyright (C) 2010, D. R. Commander
* For conditions of distribution and use, see the accompanying README file.
*
* JPEG compatibility macros

* These declarations are considered internal to the JPEG library; most
* applications using the library shouldn't need to include this file.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegcomp.h
No license file was found, but licenses were detected in source scan.

/*

* wrjpgcom.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a very simple stand-alone application that inserts

* user-supplied text as a COM (comment) marker in a JFIF file.

* This may be useful as an example of the minimum logic needed to parse

* JPEG markers.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrjpgcom.c
No license file was found, but licenses were detected in source scan.

TurboJPEG Java Wrapper

=====

The TurboJPEG shared library can optionally be built with a Java Native Interface wrapper, which allows the library to be loaded and used directly from Java applications. The Java front end for this is defined in several classes located under `org/libjpegturbo/turbojpeg`. The source code for these Java classes is licensed under a BSD-style license, so the files can be incorporated directly into both open source and proprietary projects without restriction. A Java archive (JAR) file containing these classes is also shipped with the "official" distribution packages of `libjpeg-turbo`.

`TJExample.java`, which should also be located in the same directory as this README file, demonstrates how to use the TurboJPEG Java API to compress and decompress JPEG images in memory.

Performance Pitfalls

The TurboJPEG Java API defines several convenience methods that

can allocate image buffers or instantiate classes to hold the result of compress, decompress, or transform operations. However, if you use these methods, then be mindful of the amount of new data you are creating on the heap. It may be necessary to manually invoke the garbage collector to prevent heap exhaustion or to prevent performance degradation. Background garbage collection can kill performance, particularly in a multi-threaded environment (Java pauses all threads when the GC runs.)

The TurboJPEG Java API always gives you the option of pre-allocating your own source and destination buffers, which allows you to re-use those buffers for compressing/decompressing multiple images. If the image sequence you are compressing or decompressing consists of images of the same size, then pre-allocating the buffers is recommended.

Installation Directory

If the TurboJPEG JNI library (libturbojpeg.so, libturbojpeg.jnilib, or turbojpeg.dll) is not installed under a system library directory or under a directory specified in LD_LIBRARY_PATH (Unix) or PATH (Windows), then you will need to pass an argument of -Djava.library.path={path_to_JNI_library} to java.

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/README
No license file was found, but licenses were detected in source scan.

/*

* jidctred.c

*

* Copyright (C) 1994-1998, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains inverse-DCT routines that produce reduced-size output:

* either 4x4, 2x2, or 1x1 pixels from an 8x8 DCT block.

*

* The implementation is based on the Loeffler, Ligtenberg and Moschytz (LL&M)

* algorithm used in jidctint.c. We simply replace each 8-to-8 1-D IDCT step

* with an 8-to-4 step that produces the four averages of two adjacent outputs

* (or an 8-to-2 step producing two averages of four outputs, for 2x2 output).

* These steps were derived by computing the corresponding values at the end

* of the normal LL&M code, then simplifying as much as possible.

*

* 1x1 is trivial: just take the DC coefficient divided by 8.

*
* See jidctint.c for additional comments.
*/

Found in path(s):

*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctred.c
No license file was found, but licenses were detected in source scan.

/*
* jcdctmgr.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright (C) 2011 D. R. Commander
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the forward-DCT management logic.
* This code selects a particular DCT implementation to be used,
* and it performs related housekeeping chores including coefficient
* quantization.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcdctmgr.c
No license file was found, but licenses were detected in source scan.

/*
* jccolor.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright (C) 2009-2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input colorspace conversion routines.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccolor.c

No license file was found, but licenses were detected in source scan.

```
{\rtf1\ansi\ansicpg1252\cocoartf1038\cocoasubrtf360
{\fonttbl{\f0\fswiss\fcharset0 Helvetica;}
{\colortbl;\red255\green255\blue255;}
\margl1440\margr1440\vieww26380\viewh15840\viewkind0
\defstab720
\pard\pardefstab720\ql\qnatural
```

libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG API. libjpeg-turbo also features colorspace extensions that allow it to compress from/decompress to 32-bit and big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/ReadMe.rtf
No license file was found, but licenses were detected in source scan.
```

```
/*
* jdphuff.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy decoding routines for progressive JPEG.
*
* Much of the complexity here has to do with supporting input suspension.
* If the data source module demands suspension, we want to be able to back
* up to the start of the current MCU. To do this, we copy state variables
* into local working storage, and update them back to the permanent
* storage only upon successful completion of an MCU.
*/
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdphuff.c

No license file was found, but licenses were detected in source scan.

/*

* jcarith.c

*

* Developed 1997-2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains portable arithmetic entropy encoding routines for JPEG

* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).

*

* Both sequential and progressive modes are supported in this single module.

*

* Suspension is not currently supported in this module.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcarith.c

No license file was found, but licenses were detected in source scan.

/*

* jdatadst.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2009-2012 by Guido Vollbeding.

* Modifications:

* Copyright (C) 2013, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains compression data destination routines for the case of

* emitting JPEG data to memory or to a file (or any stdio stream).

* While these routines are sufficient for most applications,

* some will want to use a different destination manager.

* IMPORTANT: we assume that fwrite() will correctly transcribe an array of

* JOCTETs into 8-bit-wide elements on external storage. If char is wider

* than 8 bits on your machine, you may need to do some tweaking.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatadst.c

No license file was found, but licenses were detected in source scan.

```
/*
 * cjpeg.c
 *
 * This file was part of the Independent JPEG Group's software:
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modified 2003-2011 by Guido Vollbeding.
 * Modifications:
 * Copyright (C) 2010, 2013, D. R. Commander.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a command-line user interface for the JPEG compressor.
 * It should work on any system with Unix- or MS-DOS-style command lines.
 *
 * Two different command line styles are permitted, depending on the
 * compile-time switch TWO_FILE_COMMANDLINE:
 * cjpeg [options] inputfile outputfile
 * cjpeg [options] [inputfile]
 * In the second style, output is always to standard output, which you'd
 * normally redirect to a file or pipe to some other program. Input is
 * either from a named file or from standard input (typically redirected).
 * The second style is convenient on Unix but is unhelpful
 * on systems that
 * don't support pipes. Also, you MUST use the first style if your system
 * doesn't do binary I/O to stdin/stdout.
 * To simplify script writing, the "-outfile" switch is provided. The syntax
 * cjpeg [options] -outfile outputfile inputfile
 * works regardless of which command line style is used.
 */
```

Found in path(s):

```
*/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cjpeg.c
No license file was found, but licenses were detected in source scan.
```

```
/*
 * wrtarga.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to write output images in Targa format.
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume output to
 * an ordinary stdio stream.
 *
 * Based on code contributed by Lee Daniel Crocker.
```

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrtarga.c
No license file was found, but licenses were detected in source scan.

/*

* jdmerge.c

*

* This file was part of the Independent JPEG Group's software:

* Copyright (C) 1994-1996, Thomas G. Lane.

* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB

* Modifications:

* Copyright (C) 2009, 2011, D. R. Commander.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains code for merged upsampling/color conversion.

*

* This file combines functions from jdsample.c and jdcolor.c;

* read those files first to understand what's going on.

*

* When the chroma components are to be upsampled by simple replication

* (ie, box filtering), we can save some work in color conversion by

* calculating all the output pixels corresponding to a pair of chroma

* samples at one time. In the conversion equations

* $R = Y + K1 * Cr$

* $G = Y + K2 * Cb + K3 * Cr$

* $B = Y + K4 * Cb$

* only the Y term varies among the group of pixels corresponding
to a pair

* of chroma samples, so the rest of the terms can be calculated just once.

* At typical sampling ratios, this eliminates half or three-quarters of the

* multiplications needed for color conversion.

*

* This file currently provides implementations for the following cases:

* YCbCr => RGB color conversion only.

* Sampling ratios of 2h1v or 2h2v.

* No scaling needed at upsample time.

* Corner-aligned (non-CCIR601) sampling alignment.

* Other special cases could be added, but in most applications these are

* the only common cases. (For uncommon cases we fall back on the more

* general code in jdsample.c and jdcolor.c.)

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmerge.c

No license file was found, but licenses were detected in source scan.

```
;
;jsimdext.inc - common declarations
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
; Copyright 2010 D. R. Commander
;
; Based on
; x86 SIMD extension for IJG JPEG library - version 1.02
;
; Copyright (C) 1999-2006, MIYASAKA Masaru.
;
; This software is provided 'as-is', without any express or implied
; warranty. In no event will the authors be held liable for any damages
; arising from the use of this software.
;
; Permission is granted to anyone to use this software for any purpose,
; including commercial applications, and to alter it and redistribute it
; freely, subject to the following restrictions:
;
; 1. The origin of this software must not be misrepresented; you must not
; claim that you wrote the original software. If you use this software
; in a product, an acknowledgment in the product documentation would be
; appreciated but is not required.
; 2. Altered source versions must
; be plainly marked as such, and must not be
; misrepresented as being the original software.
; 3. This notice may not be removed or altered from any source distribution.
;
; [TAB8]

; =====
; System-dependent configurations

#ifdef WIN32 ; ---(nasm -fwin32 -DWIN32 ...)-----
; * Microsoft Visual C++
; * MinGW (Minimalist GNU for Windows)
; * CygWin
; * LCC-Win32

; -- segment definition --
;
#ifdef __YASM_VER__
#define SEG_TEXT .text align=16
#define SEG_CONST .rdata align=16
#else
#define SEG_TEXT .text align=16 public use32 class=CODE
```

```

%define SEG_CONST .rdata align=16 public use32 class=CONST
%endif

%elifdef WIN64 ; ----(nasm -fwin64 -DWIN64 ...)-----
; * Microsoft Visual C++

; -- segment definition --
;
%ifdef __YASM_VER__
%define SEG_TEXT .text align=16
%define SEG_CONST .rdata align=16
%else
%define SEG_TEXT .text align=16 public use64 class=CODE
%define SEG_CONST .rdata align=16
public use64 class=CONST
%endif
%define EXTN(name) name ; foo() -> foo

%elifdef OBJ32 ; ----(nasm -fobj -DOBJ32 ...)-----
; * Borland C++ (Win32)

; -- segment definition --
;
%define SEG_TEXT .text align=16 public use32 class=CODE
%define SEG_CONST .data align=16 public use32 class=DATA

%elifdef ELF ; ----(nasm -felf[64] -DELFB ...)-----
; * Linux
; * *BSD family Unix using elf format
; * Unix System V, including Solaris x86, UnixWare and SCO Unix

; mark stack as non-executable
section .note.GNU-stack noalloc noexec nowrite progbits

; -- segment definition --
;
%ifdef __x86_64__
%define SEG_TEXT .text progbits align=16
%define SEG_CONST .rodata progbits align=16
%else
%define SEG_TEXT .text progbits alloc exec nowrite align=16
%define SEG_CONST .rodata progbits alloc noexec nowrite align=16
%endif

; To make the code position-independent, append -DPIC to the commandline
;
%define GOT_SYMBOL _GLOBAL_OFFSET_TABLE_ ; ELF supports PIC
%define EXTN(name)

```

```

name ; foo() -> foo

%elifdef AOUT ; ----(nasm -faout/aout -DAOUT ...)----
; * Older Linux using a.out format (nasm -f aout -DAOUT ...)
; * *BSD family Unix using a.out format (nasm -f aoutb -DAOUT ...)

; -- segment definition --
;
%define SEG_TEXT .text
%define SEG_CONST .data

; To make the code position-independent, append -DPIC to the commandline
;
%define GOT_SYMBOL __GLOBAL_OFFSET_TABLE_ ; BSD-style a.out supports PIC

%elifdef MACHO ; ----(nasm -fmacho -DMACHO ...)-----
; * NeXTstep/OpenStep/Rhapsody/Darwin/MacOS X (Mach-O format)

; -- segment definition --
;
%define SEG_TEXT .text ;align=16 ; nasm doesn't accept align=16. why?
%define SEG_CONST .rodata align=16

; The generation of position-independent code (PIC) is the default on Darwin.
;
%define PIC
%define GOT_SYMBOL _MACHO_PIC_ ; Mach-O style code-relative addressing

%else ; ----(Other case)-----

; -- segment definition --
;
%define SEG_TEXT .text
%define SEG_CONST
.data

%endif ; -----

; =====

; -----
; Common types
;
%ifdef __x86_64__
%define POINTER qword ; general pointer type
%define SIZEOF_POINTER SIZEOF_QWORD ; sizeof(POINTER)
%define POINTER_BIT QWORD_BIT ; sizeof(POINTER)*BYTE_BIT
%else

```

```

#define POINTER          dword          ; general pointer type
#define SIZEOF_POINTER  SIZEOF_DWORD   ; sizeof(POINTER)
#define POINTER_BIT     DWORD_BIT      ; sizeof(POINTER)*BYTE_BIT
#endif

#define INT              dword          ; signed integer type
#define SIZEOF_INT      SIZEOF_DWORD   ; sizeof(INT)
#define INT_BIT         DWORD_BIT      ; sizeof(INT)*BYTE_BIT

#define FP32            dword          ; IEEE754 single
#define SIZEOF_FP32    SIZEOF_DWORD
; sizeof(FP32)
#define FP32_BIT       DWORD_BIT      ; sizeof(FP32)*BYTE_BIT

#define MMWORD          qword          ; int64 (MMX register)
#define SIZEOF_MMWORD  SIZEOF_QWORD   ; sizeof(MMWORD)
#define MMWORD_BIT     QWORD_BIT      ; sizeof(MMWORD)*BYTE_BIT

; NASM is buggy and doesn't properly handle operand sizes for SSE
; instructions, so for now we have to define XMMWORD as blank.
#define XMMWORD         ; int128 (SSE register)
#define SIZEOF_XMMWORD SIZEOF_OWORD   ; sizeof(XMMWORD)
#define XMMWORD_BIT    OWORD_BIT      ; sizeof(XMMWORD)*BYTE_BIT

; Similar hacks for when we load a dword or MMWORD into an xmm# register
#define XMM_DWORD
#define XMM_MMWORD

#define SIZEOF_BYTE     1             ; sizeof(BYTE)
#define SIZEOF_WORD     2             ; sizeof(WORD)
#define SIZEOF_DWORD    4             ; sizeof(DWORD)
#define SIZEOF_QWORD    8
; sizeof(QWORD)
#define SIZEOF_OWORD    16            ; sizeof(OWORD)

#define BYTE_BIT       8             ; CHAR_BIT in C
#define WORD_BIT       16            ; sizeof(WORD)*BYTE_BIT
#define DWORD_BIT     32            ; sizeof(DWORD)*BYTE_BIT
#define QWORD_BIT     64            ; sizeof(QWORD)*BYTE_BIT
#define OWORD_BIT     128           ; sizeof(OWORD)*BYTE_BIT

; -----
; External Symbol Name
;
%ifndef EXTN
#define EXTN(name) _ %+ name ; foo() -> _foo
#endif

```



```

; -----
; Macros for position-independent code (PIC) support
;
%ifndef GOT_SYMBOL
%undef PIC
%endif

%ifdef PIC ; -----

%ifidn GOT_SYMBOL,_MACHO_PIC_ ; -----

; At present, nasm doesn't seem to support PIC generation for Mach-O.
; The PIC support code below is a
; little tricky.

SECTION SEG_CONST
const_base:

%define GOTOFF(got,sym) (got) + (sym) - const_base

%imacro get_GOT 1
; NOTE: this macro destroys ecx register.
call %%geteip
add ecx, byte (%%ref - $)
jmp short %%adjust
%%geteip:
mov ecx, POINTER [esp]
ret
%%adjust:
push ebp
xor ebp,ebp ; ebp = 0
%ifidni %1,ebx ; (%1 == ebx)
; db 0x8D,0x9C + jmp near const_base =
; lea ebx, [ecx+ebp*8+(const_base-%%ref)] ; 8D,9C,E9,(offset32)
db 0x8D,0x9C ; 8D,9C
jmp near const_base ; E9,(const_base-%%ref)
%%ref:
%else ; (%1 != ebx)
; db 0x8D,0x8C + jmp near const_base =
; lea ecx, [ecx+ebp*8+(const_base-%%ref)] ; 8D,8C,E9,(offset32)
db 0x8D,0x8C ; 8D,8C
jmp near const_base ; E9,(const_base-%%ref)
%%ref: mov %1, ecx
%endif ; (%1 == ebx)
pop ebp
%endmacro

%else ; GOT_SYMBOL != _MACHO_PIC_ -----

```

```

%define GOTOFF(got,sym) (got) + (sym) wrt ..gotoff

%imacro get_GOT 1
extern GOT_SYMBOL
call %%geteip
add %1, GOT_SYMBOL + $$ - $ wrt ..gotpc
jmp short %%done
%%geteip:
mov %1,
POINTER [esp]
ret
%%done:
%endmacro

%endif ; GOT_SYMBOL == _MACHO_PIC_ -----

%imacro pushpic 1.nolist
push %1
%endmacro
%imacro poppic 1.nolist
pop %1
%endmacro
%imacro movpic 2.nolist
mov %1,%2
%endmacro

%else ; !PIC -----

%define GOTOFF(got,sym) (sym)

%imacro get_GOT 1.nolist
%endmacro
%imacro pushpic 1.nolist
%endmacro
%imacro poppic 1.nolist
%endmacro
%imacro movpic 2.nolist
%endmacro

%endif ; PIC -----

; -----
; Align the next instruction on {2,4,8,16,..}-byte boundary.
; ".balign n,,m" in GNU as
;
%define MSKLE(x,y) (~(((y) & 0xFFFF) - ((x) & 0xFFFF)) >> 16)
%define FILLB(b,n) (($-(b)) & ((n)-1))

```

```

%imacro alignx 1-2.nolist 0xFFFF
%%bs: times MSKLE(FILLB(%%bs,%1),%2) & MSKLE(16,FILLB($,%1)) & FILLB($,%1) \
    db 0x90                ; nop
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/9 \

    db 0x8D,0x9C,0x23,0x00,0x00,0x00,0x00 ; lea ebx,[ebx+0x00000000]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/7 \
    db 0x8D,0xAC,0x25,0x00,0x00,0x00,0x00 ; lea ebp,[ebp+0x00000000]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/6 \
    db 0x8D,0xAD,0x00,0x00,0x00,0x00    ; lea ebp,[ebp+0x00000000]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/4 \
    db 0x8D,0x6C,0x25,0x00                ; lea ebp,[ebp+0x00]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/3 \
    db 0x8D,0x6D,0x00                    ; lea ebp,[ebp+0x00]
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/2 \
    db 0x8B,0xED                        ; mov ebp,ebp
times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/1 \
    db 0x90                ; nop
%endmacro

; Align the next data on {2,4,8,16,..}-byte boundary.
;
%imacro alignz 1.nolist
align %1, db 0 ; filling zeros
%endmacro

%ifdef __x86_64__

%ifdef WIN64

%imacro collect_args 0
push r12
push r13
push r14
push r15
mov
r10, rcx
mov r11, rdx
mov r12, r8
mov r13, r9
mov r14, [rax+48]
mov r15, [rax+56]
push rsi
push rdi
sub  rsp, SIZEOF_XMMWORD
movaps XMMWORD [rsp], xmm6
sub  rsp, SIZEOF_XMMWORD

```

```
movaps XMMWORD [rsp], xmm7
```

```
%endmacro
```

```
%imacro uncollect_args 0
```

```
movaps xmm7, XMMWORD [rsp]
```

```
add rsp, SIZEOF_XMMWORD
```

```
movaps xmm6, XMMWORD [rsp]
```

```
add rsp, SIZEOF_XMMWORD
```

```
pop rdi
```

```
pop rsi
```

```
pop r15
```

```
pop r14
```

```
pop r13
```

```
pop r12
```

```
%endmacro
```

```
%else
```

```
%imacro collect_args 0
```

```
push r10
```

```
push r11
```

```
push r12
```

```
push r13
```

```
push r14
```

```
push r15
```

```
mov r10, rdi
```

```
mov r11, rsi
```

```
mov r12, rdx
```

```
mov r13, rcx
```

```
mov r14, r8
```

```
mov r15, r9
```

```
%endmacro
```

```
%imacro uncollect_args 0
```

```
pop r15
```

```
pop r14
```

```
pop r13
```

```
pop r12
```

```
pop r11
```

```
pop r10
```

```
%endmacro
```

```
%endif
```

```
%endif
```

```
;-----
```

```
; Defines picked up from the C headers
```

```
;  
%include "jsimdcfg.inc"
```

```
;------
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-  
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimdext.inc  
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* jcphuff.c
```

```
*
```

```
* Copyright (C) 1995-1997, Thomas G. Lane.
```

```
* This file is part of the Independent JPEG Group's software.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

```
*
```

```
* This file contains Huffman entropy encoding routines for progressive JPEG.
```

```
*
```

```
* We do not support output suspension in this module, since the library
```

```
* currently does not allow multiple-scan files to be written with output
```

```
* suspension.
```

```
*/
```

Found in path(s):

```
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-  
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcphuff.c  
No license file was found, but licenses were detected in source scan.
```

```
/*
```

```
* Copyright (C)2009-2012 D. R. Commander. All Rights Reserved.
```

```
*
```

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*
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```

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* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg.h
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg.c
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJBench.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjunittest.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjbench.c
No license file was found, but licenses were detected in source scan.

/*
* jcomapi.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface routines that are used for both
* compression and decompression.
*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcomapi.c
No license file was found, but licenses were detected in source scan.

```
%ifarch x86_64  
%define __lib lib64  
%else  
%define __lib lib  
%endif
```

Summary: A SIMD-accelerated JPEG codec that provides both the libjpeg and TurboJPEG APIs
Name: @PACKAGE_NAME@

```

Version: @VERSION@
Vendor: The libjpeg-turbo Project
URL: http://www.libjpeg-turbo.org
Group: System Environment/Libraries
#-->Source0: http://prdownloads.sourceforge.net/libjpeg-turbo/libjpeg-turbo-%{version}.tar.gz
Release: @BUILD@
License: BSD-style
BuildRoot: %{_blddir}/%{name}-buildroot-%{version}-%{release}
Prereq: /sbin/ldconfig
%ifarch x86_64
Provides: %{name} = %{version}-%{release}, turbojpeg = 2.00, libturbojpeg.so()(64bit)
%else
Provides: %{name} = %{version}-%{release}, turbojpeg = 2.00, libturbojpeg.so
%endif
Obsoletes: turbojpeg

%description
libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2,
NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64,
and ARM systems. On such systems,
libjpeg-turbo is generally 2-4x as fast as
libjpeg, all else being equal. On other types of systems, libjpeg-turbo can
still outperform libjpeg by a significant amount, by virtue of its
highly-optimized Huffman coding routines. In many cases, the performance of
libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less
powerful but more straightforward TurboJPEG API. libjpeg-turbo also features
colorspace extensions that allow it to compress from/decompress to 32-bit and
big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java
interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated
derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and
VirtualGL projects made numerous enhancements to the codec in 2009, and in
early 2010, libjpeg-turbo spun off into an independent project, with the goal
of making high-speed JPEG compression/decompression
technology available to a
broader range of users and developers.

#-->%prep
#-->%setup -q

#-->%build
#-->./configure libdir=/opt/%{name}/%{__lib} mandir=/opt/%{name}/man
JPEG_LIB_VERSION=@JPEG_LIB_VERSION@ SO_MAJOR_VERSION=@SO_MAJOR_VERSION@
SO_MINOR_VERSION=@SO_MINOR_VERSION@ --with-pic @RPM_CONFIG_ARGS@
#-->make DESTDIR=$RPM_BUILD_ROOT libdir=/opt/%{name}/%{__lib} mandir=/opt/%{name}/man

```

```

%install

rm -rf $RPM_BUILD_ROOT
make install DESTDIR=$RPM_BUILD_ROOT libdir=/opt/% {name} /% {__lib} mandir=/opt/% {name} /man
docdir=/opt/% {name} /doc exemplerdir=/opt/% {name} /doc
rm -f $RPM_BUILD_ROOT/opt/% {name} /% {__lib} / *.la
mkdir -p $RPM_BUILD_ROOT/usr/% {__lib}
mv $RPM_BUILD_ROOT/opt/% {name} /% {__lib} /libturbojpeg.* $RPM_BUILD_ROOT/usr/% {__lib}
/sbin/ldconfig -n $RPM_BUILD_ROOT/opt/% {name} /% {__lib}
/sbin/ldconfig -n $RPM_BUILD_ROOT/usr/% {__lib}
mkdir -p $RPM_BUILD_ROOT/usr/include
mv $RPM_BUILD_ROOT/opt/% {name} /include/turbojpeg.h $RPM_BUILD_ROOT/usr/include
ln -fs /usr/include/turbojpeg.h $RPM_BUILD_ROOT/opt/% {name} /include/
ln
-fs /usr/% {__lib} /libturbojpeg.a $RPM_BUILD_ROOT/opt/% {name} /% {__lib} /
mkdir -p $RPM_BUILD_ROOT% {_defaultdocdir}
mv $RPM_BUILD_ROOT/opt/% {name} /doc $RPM_BUILD_ROOT% {_defaultdocdir} /% {name} -% {version}

%post -p /sbin/ldconfig

%postun -p /sbin/ldconfig

%clean
rm -rf $RPM_BUILD_ROOT

%files
%defattr(-,root,root)
%dir % {_defaultdocdir} /% {name} -% {version}
%doc % {_defaultdocdir} /% {name} -% {version} /*
%dir /opt/% {name}
%dir /opt/% {name} /bin
/opt/% {name} /bin/cjpeg
/opt/% {name} /bin/djpeg
/opt/% {name} /bin/jpegtran
/opt/% {name} /bin/tjbench
/opt/% {name} /bin/rdjpgcom
/opt/% {name} /bin/wrjpgcom
%dir /opt/% {name} /% {__lib}
%ifarch x86_64
%else
/opt/% {name} /lib32
%endif
/opt/% {name} /% {__lib} /libjpeg.so.@SO_MAJOR_VERSION@.@SO_AGE@.@SO_MINOR_VERSION@
/opt/% {name} /% {__lib} /libjpeg.so.@SO_MAJOR_VERSION@
/opt/% {name} /% {__lib} /libjpeg.so
/opt/% {name} /% {__lib} /libjpeg.a
/opt/% {name} /% {__lib} /libturbojpeg.a

```


/usr/% {__lib}/libturbojpeg.so.0.0.0
/usr/% {__lib}/libturbojpeg.so.0
/usr/% {__lib}/libturbojpeg.so
/usr/% {__lib}/libturbojpeg.a
/usr/include/turbojpeg.h
%dir
/opt/% {name}/include
/opt/% {name}/include/jconfig.h
/opt/% {name}/include/jerror.h
/opt/% {name}/include/jmorecfg.h
/opt/% {name}/include/jpeglib.h
/opt/% {name}/include/turbojpeg.h
%dir /opt/% {name}/man
%dir /opt/% {name}/man/man1
/opt/% {name}/man/man1/cjpeg.1*
/opt/% {name}/man/man1/djpeg.1*
/opt/% {name}/man/man1/jpegtran.1*
/opt/% {name}/man/man1/rdjpgcom.1*
/opt/% {name}/man/man1/wrjpgcom.1*
@JAVA_RPM_CONTENTS_1@
@JAVA_RPM_CONTENTS_2@

%changelog

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/libjpeg-turbo.spec.in

No license file was found, but licenses were detected in source scan.

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Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_arm_neon.S

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/*

* jaricom.c

*

- * Developed 1997-2009 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *

* This file contains probability estimation tables for common use in
* arithmetic entropy encoding and decoding routines.
*
* This data represents Table D.2 in the JPEG spec (ISO/IEC IS 10918-1
* and CCITT Recommendation ITU-T T.81) and Table 24 in the JBIG spec
* (ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82).
*/

Found in path(s):

*/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jaricom.c
No license file was found, but licenses were detected in source scan.

/*

* jidctfst.c

/*

* Copyright (C) 1994-1998, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

/*

* This file contains a fast, not so accurate integer implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.

/*

* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to be any faster when reduced to code.

/*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.

* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.

* The primary disadvantage of this method is that with fixed-point math,
* accuracy is lost due to imprecise representation of the scaled
* quantization values. The smaller the quantization table entry, the less
* precise the scaled value, so this implementation does worse with high-
* quality-setting files than with low-quality ones.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctfst.c
No license file was found, but licenses were detected in source scan.

/*

* jpeglib.h

*

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*

* This file defines the application interface for the JPEG library.

* Most applications using the library need only include this file,

* and perhaps jerror.h if they want to know the exact error codes.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpeglib.h
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/*

* jdhuft.c

*

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*

* This file contains Huffman entropy decoding routines.

*

* Much of the complexity here has to do with supporting input suspension.

* If the data source module demands suspension, we want to be able to back

* up to the start of the current MCU. To do this, we copy state variables

* into local working storage, and update them back to the permanent

* storage only upon successful completion of an MCU.

*/

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdhuft.c
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/*

```

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*
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*
* This file contains routines to read input images in Microsoft "BMP"
* format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).
* Currently, only 8-bit and 24-bit images are supported, not 1-bit or
* 4-bit (feeding such low-depth images into JPEG would be silly anyway).
* Also, we don't support RLE-compressed files.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already
  read some data (e.g., to determine that
* the file is indeed BMP format).
*
* This code contributed by James Arthur Boucher.
*/

```

Found in path(s):

```

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdbmp.c

```

1.148 linenoise 1.0

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1.149 hd-parm 9.38

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1.150 packaging 19.0

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1.151 shared-mime-info 1.6

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1.152 webrtc m44

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common_audio/signal_processing/spl_sqrt_floor.c
common_audio/signal_processing/spl_sqrt_floor_arm.S

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/*

* Written by Wilco Dijkstra, 1996. The following email exchange establishes the
* license.

*

* From: Wilco Dijkstra <Wilco.Dijkstra@ntlworld.com>

* Date: Fri, Jun 24, 2011 at 3:20 AM

* Subject: Re: sqrt routine

* To: Kevin Ma <kma@google.com>

* Hi Kevin,

* Thanks for asking. Those routines are public domain (originally posted to
* comp.sys.arm a long time ago), so you can use them freely for any purpose.

* Cheers,

* Wilco

*

* ----- Original Message -----

* From: "Kevin Ma" <kma@google.com>

* To: <Wilco.Dijkstra@ntlworld.com>

* Sent: Thursday, June 23, 2011 11:44 PM

* Subject: Fwd: sqrt routine

* Hi Wilco,

* I saw your sqrt routine from several web sites, including

* <http://www.finesse.demon.co.uk/steven/sqrt.html>.

* Just wonder if there's any copyright information with your Successive
* approximation routines, or if I can freely use it for any purpose.

* Thanks.

* Kevin

*/

Files:

modules/audio_coding/codecs/g711/main/source/g711.c
modules/audio_coding/codecs/g711/main/source/g711.h

License:

/*

* SpanDSP - a series of DSP components for telephony

*
* g711.h - In line A-law and u-law conversion routines
*
* Written by Steve Underwood <steveu@coppice.org>
*
* Copyright (C) 2001 Steve Underwood
*
* Despite my general liking of the GPL, I place this code in the
* public domain for the benefit of all mankind - even the slimy
* ones who might try to proprietize my work and use it to my
* detriment.
*/

Files:

modules/audio_coding/codecs/g722/main/source/g722_decode.c
modules/audio_coding/codecs/g722/main/source/g722_enc_dec.h
modules/audio_coding/codecs/g722/main/source/g722_encode.c

License:

/*
* SpanDSP - a series of DSP components for telephony
*
* g722_decode.c - The ITU G.722 codec, decode part.
*
* Written by Steve Underwood <steveu@coppice.org>
*
* Copyright (C) 2005 Steve Underwood
*
* Despite my general liking of the GPL, I place my own contributions
* to this code in the public domain for the benefit of all mankind -
* even the slimy ones who might try to proprietize my work and use it
* to my detriment.
*
* Based in part on a single channel G.722 codec which is:
*
* Copyright (c) CMU 1993
* Computer Science, Speech Group
* Chengxiang Lu and Alex Hauptmann
*/

Files:

modules/audio_coding/codecs/isac/main/source/fft.c

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* Queen's Univ at Kingston (Canada)
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- * that everyone benefits.
- */

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modules/audio_device/mac/portaudio/pa_memorybarrier.h
modules/audio_device/mac/portaudio/pa_ringbuffer.c
modules/audio_device/mac/portaudio/pa_ringbuffer.h

License:

```
/*
 * $Id: pa_memorybarrier.h 1240 2007-07-17 13:05:07Z bjornroche $
 * Portable Audio I/O Library
 * Memory barrier utilities
 *
 * Author: Bjorn Roche, XO Audio, LLC
 *
 * This program uses the PortAudio Portable Audio Library.
 * For more information see: http://www.portaudio.com
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 *
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*/

/*

* \$Id: pa_ringbuffer.c 1421 2009-11-18 16:09:05Z bjornroche \$

* Portable Audio I/O Library

* Ring Buffer utility.

*

* Author: Phil Burk, <http://www.softsynth.com>

* modified for SMP safety on Mac OS X by Bjorn Roche

* modified for SMP safety on Linux by Leland Lucius

* also, allowed for const where possible

* modified for multiple-byte-sized data elements by Sven Fischer

*

* Note that this is safe only for a single-thread reader and a

* single-thread writer.

*

* This program uses the PortAudio Portable Audio Library.

* For more information see: <http://www.portaudio.com>

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modules/audio_processing/aec/aec_rdfc.c

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Source:

<http://www1.cse.wustl.edu/~schmidt/ACE-copying.html>

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Files:

system_wrappers/source/set_thread_name_win.h

Source:

<http://msdn.microsoft.com/en-us/cc300389.aspx#P>

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1.155 jackson-databind 2.11.2

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```
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```
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1.158 libxcrypt 4.4.10-10ubuntu4

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1.159 hibernate-validator 6.1.5.Final

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1.160 util-linux 2.20.0

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NR	START	END	SECTORS	SIZE	NAME	UUID
1	32	7679	7648	3.7M		8f8378c0-01
2	7680	16383	8704	4.3M		8f8378c0-02
5	7936	12799	4864	2.4M		
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<one line to give the program's name and a brief idea of what it does.>

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```
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```

```
This program comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
```

```
This is free software, and you are welcome to redistribute it under certain conditions; type `show c' for details.
```

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, your program's commands might be different; for a GUI interface, you would use an "about box".

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```
WEV @@ WEV[B "1
```

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x ?"U@,5 @mISmIN<GimCN7g1u|E
 43mI,5WEV @@ WEV @mImImIAmImImI0mImImI*mImI
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 lost+found...

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!"#\$%&'()*+,-
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!"#\$%&'()*+,-
 ./0123456789;:<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

!"#\$%&'()*+,-
 ./0123456789;:<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~WEV @@
 WEV[B "1

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1.161 curl 7.62.0-DEV

1.161.1 Available under license :

License Mixing

=====

libcurl can be built to use a fair amount of various third party libraries, libraries that are written and provided by other parties that are distributed using their own licenses. Even libcurl itself contains code that may cause problems to some. This document attempts to describe what licenses libcurl and the other libraries use and what possible dilemmas linking and mixing them all can lead to for end users.

I am not a lawyer and this is not legal advice!

One common dilemma is that [GPL](<https://www.gnu.org/licenses/gpl.html>) licensed code is not allowed to be linked with code licensed under the [Original BSD license](<https://spdx.org/licenses/BSD-4-Clause.html>) (with the announcement clause). You may still build your own copies that use them all, but distributing them as binaries would be to violate the GPL license - unless you accompany your license with an [exception](<https://www.gnu.org/licenses/gpl-faq.html#GPLIncompatibleLibs>). This particular problem was addressed when the [Modified BSD license](<https://opensource.org/licenses/BSD-3-Clause>) was created, which does not have the announcement clause that collides with GPL.

libcurl

Uses an [MIT style license](<https://curl.haxx.se/docs/copyright.html>) that is very liberal.

OpenSSL

(May be used for SSL/TLS support) Uses an Original BSD-style license with an announcement clause that makes it "incompatible" with GPL. You are not allowed to ship binaries that link with OpenSSL that includes GPL code

(unless that specific GPL code includes an exception for OpenSSL - a habit that is growing more and more common). If OpenSSL's licensing is a problem for you, consider using another TLS library.

GnuTLS

(May be used for SSL/TLS support) Uses the [LGPL](<https://www.gnu.org/licenses/lgpl.html>) license. If this is a problem for you, consider using another TLS library. Also note that GnuTLS itself depends on and uses other libs (libgcrypt and libgpg-error) and they too are LGPL- or GPL-licensed.

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BoringSSL

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libressl

(May be used for SSL/TLS support) As an OpenSSL fork, it has the same license as that.

c-ares

(Used for asynchronous name resolves) Uses an MIT license that is very

liberal and imposes no restrictions on any other library or part you may link with.

zlib

(Used for compressed Transfer-Encoding support) Uses an MIT-style license that shouldn't collide with any other library.

MIT Kerberos

(May be used for GSS support) MIT licensed, that shouldn't collide with any other parts.

Heimdal

(May be used for GSS support) Heimdal is Original BSD licensed with the announcement clause.

GNU GSS

(May be used for GSS support) GNU GSS is GPL licensed. Note that you may not distribute binary curl packages that uses this if you build curl to also link and use any Original BSD licensed libraries!

libidn

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OpenLDAP

(Used for LDAP support) Uses a Modified BSD-style license. Since libcurl uses OpenLDAP as a shared library only, I have not heard of anyone that ships OpenLDAP linked with libcurl in an app.

libssh2

(Used for scp and sftp support) libssh2 uses a Modified BSD-style license.
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1.162 flyway-core 7.3.1

1.162.1 Available under license :

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Found in path(s):

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/META-INF/maven/org.flywaydb/flyway-core/pom.xml

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*/

Found in path(s):

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/VersionPrinter.java
*
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/command/DbRepair.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/InsertRowLock.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/PlaceholderReplacingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/clazz/NoopClassProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/MigrateResult.java
*
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/SchemaObject.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/JdbcNullTypes.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

```

jar/org/flywaydb/core/internal/strategy/BackoffStrategy.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseDatabaseType.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/Locations.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutorFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/ResourceNameCache.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/jboss/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/base/DatabaseType.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/informix/InformixDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/logging/LogFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlStatement.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/DateUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/log4j2/Log4j2Log.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Table.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/BaselineResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/PositionTrackingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/ClasspathClassScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/Location.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/Warning.java

```

```

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/callback/SimpleContext.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/OperationResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sybasease/SybaseASETTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/configuration/ConfigUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/WarningImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Connection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/Recorder.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/derby/DerbyParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/ErrorOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/JarUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/android/ContextHolder.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlite/SQLiteParser.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleResults.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/ValidateOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/filesystem/FileSystemScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/ValidateResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/authentication/ExternalAuthPropertiesProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

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jar/org/flywaydb/core/internal/callback/SqlScriptCallbackFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/ParsingContext.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/slf4j/Slf4jLog.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/authentication/postgres/PgpassFileReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlite/SQLiteDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/migration/Context.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/ResolvedMigrationImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLog.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/s3/AwsS3Resource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/CloseableIterator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/exception/FlywayDbUpgradeRequiredException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/h2/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/cockroachdb/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/mysql/MySQLParser.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/h2/H2DatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/derby/DerbyDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sybasease/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/configuration/Configuration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/AsciiTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/ExecutionTemplateFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/sql/package-info.java

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/SqlCallable.java

*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsql/HSQLDBParser.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabaseType.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/RepairOutput.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybase/SybaseASEJConnectDatabaseType.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Type.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptMetadata.java

*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/ExternalAuthFileReader.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/MigrationPattern.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLTable.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANADatabase.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/Flyway.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/classpath/ClassPathResource.java

*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/classpath/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/FlywayException.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Context.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/JavaMigration.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/RepairResult.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabase.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/schemahistory/SchemaHistory.java

*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/InformixTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarFileClassPathLocationScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/exception/FlywayValidateException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/StatementInterceptor.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/MigrationInfoContext.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/ParserSqlScript.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/ChecksumMatcher.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/BomFilter.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Statement.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/ErrorImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/LogCreatorFactory.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/slf4j/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/MigrateOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/ParserContext.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANAParser.java
*

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 jar/org/flywaydb/core/api/output/CommandResultFactory.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/resolver/java/JavaMigrationExecutor.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/snowflake/package-info.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/base/Database.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/util/FileCopyUtils.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/mysql/MySQLNamedLockTemplate.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 *
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/callback/CallbackExecutor.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/sqlserver/SQLServerSchema.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/scanner/cloud/s3/AwsS3Scanner.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/resolver/sql/DefaultSqlMigrationExecutorFactory.java
 *
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBTable.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/oracle/package-info.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/sqlserver/SQLServerConnection.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/resource/StringResource.java
 *

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/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/PositionTracker.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/PlainExecutionTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/CompositeMigrationResolver.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv2UrlResolver.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/Statement.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/BaseCallback.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/resolver/ResolvedMigration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLCopyParsedStatement.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/db2/DB2Parser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/firebird/FirebirdTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/ResourceAndClassScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleConnection.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/DefaultExecutionStrategy.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/LoadableResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/MigrationType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/CleanResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/ClassUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLog.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/package-
info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/h2/H2Table.java
*

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/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayTeamsUpgradeMessage.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/ErrorDetails.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2DatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLType.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Function.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/TokenType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/AbbreviationUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/ErrorCode.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/JdbcConnectionFactory.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Connection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Event.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/executor/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/ParsedSqlStatement.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabase.java
*

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/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/Delimiter.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/base/TestContainersDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/ExceptionUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/saphana/SAPHANAConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/RecordingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/Scanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv3ClassPathLocationScanner.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/authentication/mysql/MySQLOptionFileReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/IOUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/UrlUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/exception/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/android/AndroidResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/PeekingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/ChecksumCalculator.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerApplicationLockTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/InfoOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/Error.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/Resource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/gcs/GCSResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/OsgiClassPathLocationScanner.java
*

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/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/InfoOutputProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayEditionUpgradeRequiredException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/Context.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/BomStrippingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/UndoOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayTeamsUpgradeRequiredException.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/DatabaseTypeRegister.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASESchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/TableLockingExecutionTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/TimeFormat.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/StopWatch.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLog.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/s3/package-info.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/MigrationInfoServiceImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Schema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/configuration/S3ClientFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/UrlResolver.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerParser.java
*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/LogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/RowMapper.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceNameValidator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/executor/MigrationExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/StringUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/android/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathLocationScanner.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScript.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/FeatureDetector.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceNameParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/executor/Context.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceName.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/command/DbClean.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/java/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2Connection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/package-info.java
*

/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/package-info.java

- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/MigrationInfo.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/package-info.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/MigrationState.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/DatabaseExecutionStrategy.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/DriverDataSource.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/mariadb/MariaDBDatabase.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEJTDSDatabaseType.java
- *
- /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/mariadb/MariaDBDatabaseType.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/ConfigurationValidator.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/Edition.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBDatabase.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/package-info.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlite/package-info.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/package-info.java
- *
- /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdSchema.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdParser.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Database.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/configuration/FluentConfiguration.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/package-info.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2Schema.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/Log.java
- * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/package-info.java

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*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/snowflake/SnowflakeDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/schemahistory/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/NoopResourceProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutorFactory.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/DefaultUrlResolver.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerEngineEdition.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/informix/InformixConnection.java
*
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/callback/Callback.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/callback/NoopCallbackExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 *
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 *
 /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/database/informix/InformixSchema.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

jar/org/flywaydb/core/internal/database/cockroachdb/CockroachRetryingTransactionalExecutionTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/MigrationInfoService.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/saphana/SAPHANADatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/clazz/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/StatementType.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/configuration/ClassicConfiguration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/informix/InformixDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/saphana/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/schemahistory/JdbcTableSchemaHistory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/DefaultSqlScriptExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/command/DbBaseline.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/SqlStatementIterator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/snowflake/SnowflakeTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/strategy/RetryStrategy.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/java/ResolvedJavaMigration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseSchema.java

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 jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLAdvisoryLockTemplate.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/internal/scanner/classpath/FileSystemClassPathLocationScanner.java
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 jar/org/flywaydb/core/internal/jdbc/package-info.java
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 *
 /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
 jar/org/flywaydb/core/api/output/OperationResultBase.java
 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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 * /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/info/MigrationInfoImpl.java
*
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jar/org/flywaydb/core/internal/sqlscript/FlywaySqlScriptException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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jar/org/flywaydb/core/internal/database/derby/DerbySchema.java
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jar/org/flywaydb/core/internal/schemahistory/AppliedMigration.java
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jar/org/flywaydb/core/internal/exception/FlywaySqlException.java
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jar/org/flywaydb/core/internal/sqlscript/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/command/DbSchemas.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/UnboundedReadAheadReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/CompositeResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/informix/InformixParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/saphana/SAPHANASchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/command/DbInfo.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/MigrationVersion.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/base/Table.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/MigrationInfoHelper.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/Token.java

```
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/UndoResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/log4j2/Log4j2LogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/android/package-info.java
*
/opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBSchema.java
```

1.163 sg3-utils 1.42

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1.167 Lombok 1.18.12

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1.168 reactive-streams 1.0.3

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```
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-  
jar/org/reactivestreams/Publisher.java  
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-  
jar/org/reactivestreams/FlowAdapters.java  
*  
/opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-  
jar/org/reactivestreams/Processor.java  
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-  
jar/org/reactivestreams/Subscription.java  
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-  
jar/org/reactivestreams/Subscriber.java
```

1.169 commons-dbcp 1.4

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1.170 jul-to-slf4j 1.7.30

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* /opt/cola/permits/1135864176_1613618002.1/0/jul-to-slf4j-1-7-30-sources-1-
jar/org/slf4j/bridge/SLF4JBridgeHandler.java

1.171 aspect-j 1.9.6

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1.172 asm 5.0.4

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jar/org/objectweb/asm/commons/package.html
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/package.html
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/package.html
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/signature/package.html
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/package.html
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/package.html
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jar/org/objectweb/asm/xml/SAXClassAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/xml/SAXAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/xml/SAXAnnotationAdapter.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/Processor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/xml/SAXFieldAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/xml/ASMContentHandler.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/xml/SAXCodeAdapter.java

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*/

/**

* Creates a new {@link GeneratorAdapter}. *Subclasses must not use this*

* constructor*.* Instead, they must use the

* {@link #GeneratorAdapter(int, MethodVisitor, int, String, String)}

* version.

*

* @param mv

* the

method visitor to which this adapter delegates calls.

* @param access

```
*      the method's access flags (see { @link Opcodes }).
* @param name
*      the method's name.
* @param desc
*      the method's descriptor (see { @link Type Type }).
* @throws IllegalStateException
*      If a subclass calls this constructor.
*/
```

Found in path(s):

```
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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```

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```

```
*/
```

```
/**
```

```
* Creates a new JSRInliner. <i>Subclasses must not use this
* constructor</i>. Instead, they must use the
* { @link #JSRInlinerAdapter(int, MethodVisitor, int, String, String, String, String[])}
```

```

* version.
*
* @param mv
*
the <code>MethodVisitor</code> to send the resulting inlined
*     method code to (use <code>null</code> for none).
* @param access
*     the method's access flags (see { @link Opcodes }). This
*     parameter also indicates if the method is synthetic and/or
*     deprecated.
* @param name
*     the method's name.
* @param desc
*     the method's descriptor (see { @link Type }).
* @param signature
*     the method's signature. May be <tt>null</tt>.
* @param exceptions
*     the internal names of the method's exception classes (see
*     { @link Type#getInternalName() getInternalName }). May be
*     <tt>null</tt>.
* @throws IllegalStateException
*     If a subclass calls this constructor.
*/

```

Found in path(s):

```

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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```

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*/

/**

* Constructs a new {@link ClassNode}. *Subclasses must not use this*
* constructor*.* Instead, they must use the {@link #ClassNode(int)}
* version.
*
* @throws IllegalStateException
* If a subclass calls this constructor.
*/

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/ClassNode.java

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*/

/**

* Constructs a new {@link Textifier}. *Subclasses must not use this
* constructor*. Instead, they must use the {@link #Textifier(int)}
* version.

*

* @throws IllegalStateException

* If a subclass calls this constructor.

*/

Found in path(s):

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Textifier.java

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*/

/**

* Constructs a new {@link LocalVariableAnnotationNode}. *<i>Subclasses must*
* not use this constructor*</i>. Instead, they must use the*

* {@link #LocalVariableAnnotationNode(int, TypePath, LabelNode[], LabelNode[], int[], String)}

* version.

*

* @param typeRef

* a reference to the annotated type. See {@link TypeReference}.

* @param typePath

* the path to the annotated type argument, wildcard bound, array

* element type, or static inner type within 'typeRef'. May be

* `<tt>null</tt>` if the annotation targets 'typeRef' as a whole.

* @param start

* the first instructions corresponding to the continuous ranges

* that make the scope of this local variable (inclusive).

* @param end

* the last instructions corresponding to the continuous ranges

* that make the scope of this local variable (exclusive). This

* array must have the same size as the 'start' array.

* @param index

* the local variable's index in each range. This array must have

* the same size as the 'start' array.

* @param desc

* the class descriptor of

the annotation class.

*/

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LocalVariableAnnotationNode.java

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Label.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Type.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/AnnotationWriter.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/SimpleVerifier.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/NameMapping.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Printer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/Shrinker.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/Method.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/CheckAnnotationAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/RemappingSignatureAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/RemappingFieldAdapter.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Attribute.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/SourceInterpreter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/MethodInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/MethodVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-

jar/org/objectweb/asm/util/TraceFieldVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/SourceValue.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/AdviceAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/Remapper.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/BasicValue.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ByteVector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/AbstractInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/Interpreter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/JumpInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/TableSwitchGenerator.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FieldNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/FieldInsnNode.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LabelNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/ClassConstantsCollector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/CheckSignatureAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/BasicVerifier.java
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jar/org/objectweb/asm/commons/CodeSizeEvaluator.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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jar/org/objectweb/asm/commons/RemappingClassAdapter.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/MultiANewArrayInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassReader.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/VarInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/RemappingMethodAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/AnnotationVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnNode.java
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jar/org/objectweb/asm/optimizer/JarOptimizer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/LocalVariablesSorter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/TraceAnnotationVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/Constant.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/TypeAnnotationNode.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Handle.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/TryCatchBlockNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/ASMifier.java
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 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldVisitor.java
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 jar/org/objectweb/asm/util/TraceMethodVisitor.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
 jar/org/objectweb/asm/optimizer/MethodConstantsCollector.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Handler.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
 jar/org/objectweb/asm/tree/MethodNode.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnList.java
 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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 *
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 * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
 jar/org/objectweb/asm/tree/analysis/BasicInterpreter.java

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/signature/SignatureWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/TryCatchBlockSorter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Item.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Edge.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FrameNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ConstantPool.java
*
/opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Opcodes.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckClassAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/signature/SignatureVisitor.java
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```

*/
/**
 * Creates a new {@link AnalyzerAdapter}. Subclasses must not use this
 * constructor. Instead, they must use the
 * {@link #AnalyzerAdapter(int, String, int, String, String, MethodVisitor)}
 * version.
 *
 * @param owner
 *
 *     the owner's class name.
 * @param access
 *     the method's access flags (see {@link Opcodes}).
 * @param name
 *     the method's name.
 * @param desc
 *     the method's descriptor (see {@link Type Type}).
 * @param mv
 *     the method visitor to which this adapter delegates calls. May
 *     be null.
 * @throws IllegalStateException
 *     If a subclass calls this constructor.
 */

```

Found in path(s):

```

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/AnalyzerAdapter.java

```

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1.173 jakarta-annotation-api 1.3.5

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1.175 classmate 1.5.1

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Java ClassMate library was originally written by Tatu Saloranta (tatu.saloranta@iki.fi)

Other developers who have contributed code are:

* Brian Langel

1.176 commons-lang3 3.10

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Validator.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/package-info.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/ValidationTarget.java
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jar/javax/validation/valueextraction/UnwrapByDefault.java
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/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintViolation.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ValidateUnwrappedValue.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/SupportedValidationTarget.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/ValidationProvider.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ElementKind.java
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/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/GroupConversionDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ExtractedValue.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/GenericBootstrap.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/MethodType.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractorDeclarationException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ConstructorDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/package-info.java
*
/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/AssertTrue.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Path.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/PositiveOrZero.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractorDefinitionException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/BootstrapConfiguration.java

*
/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ElementDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ContainerElementTypeDescriptor.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/NoProviderFoundException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Validation.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Constraint.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/CrossParameterDescriptor.java
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jar/javax/validation/constraints/PastOrPresent.java
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jar/javax/validation/ConstraintViolationException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/bootstrap/package-info.java
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jar/javax/validation/executable/ExecutableValidator.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/ValidationProviderResolver.java
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jar/javax/validation/ValidatorFactory.java
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/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
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jar/javax/validation/metadata/ConstraintDescriptor.java
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jar/javax/validation/constraints/package-info.java
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jar/javax/validation/GroupSequence.java
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jar/javax/validation/ConstraintValidatorFactory.java
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jar/javax/validation/ValidationException.java
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jar/javax/validation/OverridesAttribute.java
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jar/javax/validation/spi/BootstrapState.java
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jar/javax/validation/constraints/Email.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/ConstraintDeclarationException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/metadata/PropertyDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/ConstraintValidator.java

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*
/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/executable/ExecutableType.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/constraints/AssertFalse.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/constraints/Future.java
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jar/javax/validation/constraints/DecimalMax.java
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jar/javax/validation/constraints/Positive.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/constraints/NotEmpty.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/spi/ConfigurationState.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/Payload.java
*
/opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/constraints/DecimalMin.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-
jar/javax/validation/constraints/Past.java
No license file was found, but licenses were detected in source scan.

```

~ Jakarta Bean Validation API

~

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<![CDATA[

Comments to: <bean-validation-dev@eclipse.org>.

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Found in path(s):

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/META-
INF/maven/jakarta.validation/jakarta.validation-api/pom.xml

```

1.179 hibernate-commons-annotations

5.1.0.Final

1.179.1 Available under license :

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Version 2.1, February 1999

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a) Accompany

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b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate

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c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

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1.180 log4j-to-slf4j 2.13.3

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1.181 javassist 3.24.0-GA

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/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/StringMemberValue.java
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/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/runtime/Inner.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/DuplicateMemberException.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtClassType.java
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 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/Util.java
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 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/ControlFlow.java
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 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/CodeIterator.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/scopedpool/ScopedClassPoolRepository.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CodeConverter.java
 * /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Stmnt.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtNewClass.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtClass.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
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jar/javassist/compiler/MemberResolver.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/RemoteException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/Executor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/MultiType.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/MethodDecl.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ClassFile.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/MultiArrayType.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CannotCompileException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/RuntimeSupport.java
*
/opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/AttributeInfo.java

* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/FieldInfo.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/ObjectNotFoundException.java

1.182 postgresql-jdbc 42.2.14

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1.183 tomcat-embed-websocket 9.0.37

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1.187 jaxb-runtime 2.3.3

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1.188 libtasn 4.16.0-2

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Version 3, 29 June 2007

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1.190 grpc-go 1.9.1

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1.191 libdrm 2.4.45

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1.192 util-linux 2.28

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1.193 log4j-api 2.13.3

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1.194 freerdp 2.1.2

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1.195 luxon 1.25.1

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1.196 rrule 2.6.8

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rrule.js: Library for working with recurrence rules for calendar dates.

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1.197 react-zoom-pan-pinch 1.6.1

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1.198 react-day-picker 7.4.8

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1.199 libgcrypt 1.7.3

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Go support for Protocol Buffers - Google's data interchange format

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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1.204 importlib-metadata 0.18

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1.205 urllib3 1.25.3

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Contributions to the urllib3 project

Creator & Maintainer

* Andrey Petrov <andrey.petrov@shazow.net>

Contributors

In chronological order:

* victor.vde <<http://code.google.com/u/victor.vde/>>

* HTTPS patch (which inspired HTTPSConnectionPool)

* erikcederstrand <<http://code.google.com/u/erikcederstrand/>>

* NTLM-authenticated HTTPSConnectionPool

* Basic-authenticated HTTPSConnectionPool (merged into make_headers)

* niphlod <niphlod@gmail.com>

* Client-verified SSL certificates for HTTPSConnectionPool

* Response gzip and deflate encoding support

* Better unicode support for filepost using StringIO buffers

* btoconnor <brian@btoconnor.net>

* Non-multipart encoding for POST requests

* p.dobrogost <<http://code.google.com/u/@WBRSRIBZDhBFXQB6/>>

* Code review, PEP8 compliance, benchmark fix

* kennethreitz <me@kennethreitz.com>

* Bugfixes, suggestions, Requests integration

* georgemarshall <<https://github.com/georgemarshall>>

* Bugfixes, Improvements and Test

coverage

- * Thomas Kluyver <thomas@kluyver.me.uk>
 - * Python 3 support

- * brandon-rhodes <<http://rhodesmill.org/brandon>>
 - * Design review, bugfixes, test coverage.

- * studer <theo.studer@gmail.com>
 - * IPv6 url support and test coverage

- * Shivaram Lingamneni <slingamn@cs.stanford.edu>
 - * Support for explicitly closing pooled connections

- * hartator <hartator@gmail.com>
 - * Corrected multipart behavior for params

- * Thomas Weischuh <thomas@t-8ch.de>
 - * Support for TLS SNI
 - * API unification of ssl_version/cert_reqs
 - * SSL fingerprint and alternative hostname verification
 - * Bugfixes in testsuite

- * Sune Kirkeby <mig@ibofobi.dk>
 - * Optional SNI-support for Python 2 via PyOpenSSL.

- * Marc Schlaich <marc.schlaich@gmail.com>
 - * Various bugfixes and test improvements.

- * Bryce Boe <bbzbryce@gmail.com>
 - * Correct six.moves conflict
 - * Fixed pickle support of some exceptions

- * Boris Figovsky <boris.figovsky@ravellosystems.com>
 - * Allowed to skip SSL hostname verification

- * Cory Benfield
<<https://lukasa.co.uk/about/>>
 - * Stream method for Response objects.
 - * Return native strings in header values.
 - * Generate 'Host' header when using proxies.

- * Jason Robinson <jaywink@basshero.org>
 - * Add missing WrappedSocket.fileno method in PyOpenSSL

- * Audrius Butkevicius <audrius.butkevicius@elastichosts.com>
 - * Fixed a race condition

- * Stanislav Vitkovskiy <stas.vitkovsky@gmail.com>
- * Added HTTPS (CONNECT) proxy support

- * Stephen Holsapple <sholsapp@gmail.com>
- * Added abstraction for granular control of request fields

- * Martin von Gagern <Martin.vGagern@gmx.net>
- * Support for non-ASCII header parameters

- * Kevin Burke <kev@inburke.com> and Pavel Kirichenko <juanych@yandex-team.ru>
- * Support for separate connect and request timeouts

- * Peter Waller <p@pwaller.net>
- * HTTPResponse.tell() for determining amount received over the wire

- * Nipunn Koorapati <nipunn1313@gmail.com>
- * Ignore default ports when comparing hosts for equality

- * Danilo @dbrgn <https://dbrgn.ch/>
- * Disabled TLS compression by default on Python 3.2+
- * Disabled TLS compression in pyopenssl contrib module
- * Configurable cipher suites in pyopenssl contrib module

- * Roman Bogorodskiy <roman.bogorodskiy@ericsson.com>
- * Account retries on proxy errors

- * Nicolas Delaby <nicolas.delaby@ezeep.com>
- * Use the platform-specific CA certificate locations

- * Josh Schneier <https://github.com/jschneier>
- * HTTPHeaderDict and associated tests and docs
- * Bugfixes, docs, test coverage

- * Tahia Khan <http://tahia.tk/>
- * Added Timeout examples in docs

- * Arthur Grunseid <https://grunseid.com>
- * source_address support and tests (with https://github.com/bui)

- * Ian Cordasco <graffatcolmingov@gmail.com>
- * PEP8 Compliance and Linting
- * Add ability to pass socket options to an HTTP Connection

- * Erik Tollerud <erik.tollerud@gmail.com>
- * Support for standard library io module.

- * Krishna Prasad <kprasad.iitd@gmail.com>
- * Google App Engine documentation

- * Aaron Meurer
<asmeurer@gmail.com>
 - * Added Url.url, which unparses a Url

- * Evgeny Kapun <abacabadabacaba@gmail.com>
 - * Bugfixes

- * Benjamin Meyer <bm_witness@yahoo.com>
 - * Security Warning Documentation update for proper capture

- * Shivan Sornarajah <github@sornars.com>
 - * Support for using ConnectionPool and PoolManager as context managers.

- * Alex Gaynor <alex.gaynor@gmail.com>
 - * Updates to the default SSL configuration

- * Tomas Tomecek <ttomecek@redhat.com>
 - * Implemented generator for getting chunks from chunked responses.

- * tlynn <https://github.com/tlynn>
 - * Respect the warning preferences at import.

- * David D. Riddle <ddriddle@illinois.edu>
 - * IPv6 bugfixes in testsuite

- * Thea Flowers <magicalgirl@google.com>
 - * App Engine environment tests.
 - * Documentation re-write.

- * John Krauss <https://github.com/talos>
 - * Clues to debugging problems with `cryptography` dependency in docs

- * Disassem <https://github.com/Disassem>
 - * Fix pool-default headers not applying for url-encoded requests like GET.

- * James Atherfold <jlatherfold@hotmail.com>
 - * Bugfixes relating to cleanup of connections during errors.

- * Christian Pedersen <https://github.com/chripede>
 - * IPv6 HTTPS proxy bugfix

- * Jordan Moldow <https://github.com/jmoldow>
 - * Fix low-level exceptions leaking from ``HTTPResponse.stream()``.
 - * Bugfix for ``ConnectionPool.urlopen(release_conn=False)``.
 - * Creation of ``HTTPConnectionPool.ResponseCls``.

- * Predrag Gruevski <<https://github.com/obi1kenobi>>
- * Made cert digest comparison use a constant-time algorithm.

- * Adam Talsma <<https://github.com/a-tal>>
- * Bugfix to ca_cert file paths.

- * Evan Meagher <<https://evanmeagher.net>>
- * Bugfix related to `memoryview` usage in PyOpenSSL adapter

- * John Vandenberg <jayvdb@gmail.com>
- * Python 2.6 fixes; pyflakes and pep8 compliance

- * Andy Caldwell <andy.m.caldwell@gmail.com>
- * Bugfix related to reusing connections in indeterminate states.

- * Ville Skytt <ville.skytta@iki.fi>
- * Logging efficiency improvements, spelling fixes, Travis config.

- * Shige Takeda <smtakeda@gmail.com>
- * Started Recipes documentation and added a recipe about handling concatenated gzip data in HTTP response

- * Jess Shapiro <jesse@jesseshapiro.net>
- * Various character-encoding fixes/tweaks
- * Disabling IPv6 DNS when IPv6 connections not supported

- * David Foster <<http://dafoster.net/>>
- * Ensure order of request and response headers are preserved.

- * Jeremy Cline <jeremy@jcline.org>
- * Added connection pool keys by scheme

- * Aviv Palivoda <palaviv@gmail.com>
- * History list to Retry object.
- * HTTPResponse contains the last Retry object.

- * Nate Prewitt <nate.prewitt@gmail.com>
- * Ensure timeouts are not booleans and greater than zero.
- * Fixed infinite loop in ``stream`` when amt=None.
- * Added length_remaining to determine remaining data to be read.
- * Added enforce_content_length to raise exception when incorrect content-length received.

- * Seth Michael Larson <sethmichaellarson@protonmail.com>
- * Created selectors backport that supports PEP 475.

- * Alexandre Dias <alex.dias@smarkets.com>
- * Don't retry on timeout if method not in whitelist

- * Moinuddin Quadri <moin18@gmail.com>
- * Lazily load idna package

- * Tom White <s6yg1ez3@mail2tor.com>
- * Made SOCKS handler differentiate socks5h from socks5 and socks4a from socks4.

- * Tim Burke <tim.burke@gmail.com>
- * Stop buffering entire deflate-encoded responses.

- * Tuukka Mustonen <tuukka.mustonen@gmail.com>
- * Add counter for status_forcelist retries.

- * Erik Rose <erik@mozilla.com>
- * Bugfix to pyopenssl vendoring

- * Wolfgang Richter <wolfgang.richter@gmail.com>
- * Bugfix related to loading full certificate chains with PyOpenSSL backend.

- * Mike Miller <github@mikeage.net>
- * Logging improvements to include the HTTP(S) port when opening a new connection

- * Ioannis Tziakos <mail@itziakos.gr>
- * Fix ``util.selectors._fileobj_to_fd`` to accept ``long``.
- * Update appveyor tox setup to use the 64bit python.

- * Akamai
(through Jess Shapiro) <jshapiro@akamai.com>
- * Ongoing maintenance; 2017-2018

- * Dominique Leuenberger <dimstar@opensuse.org>
- * Minor fixes in the test suite

- * Will Bond <will@wbond.net>
- * Add Python 2.6 support to ``contrib.securetransport``

- * Aleksei Alekseev <alekseev.yeskela@gmail.com>
- * using auth info for socks proxy

- * Chris Wilcox <git@crwilcox.com>
- * Improve contribution guide
- * Add ``HTTPResponse.geturl`` method to provide ``urllib2.urlopen().geturl()`` behavior

- * Bruce Merry <https://www.brucemerry.org.za>
- * Fix leaking exceptions when system calls are interrupted with zero timeout

- * Hugo van Kemenade <https://github.com/hugovk>
- * Drop support for EOL Python 2.6

- * Tim Bell <<https://github.com/timb07>>
- * Bugfix for responses with Content-Type: message/* logging warnings

- * Justin Bramley <<https://github.com/jbramleycl>>
- * Add ability to handle multiple Content-Encodings

- * Katsuhiko YOSHIDA <<https://github.com/kyoshidajp>>
- * Remove Authorization header
regardless of case when redirecting to cross-site

- * [Your name or handle] <[email or website]>
- * [Brief summary of your changes]

1.206 python-requests 2.22.0

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1.207 attrs 19.1.0

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1.208 swagger-annotations 2.1.9

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* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/ExternalDocumentation.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-

```
jar/io/swagger/v3/oas/annotations/media/DiscriminatorMapping.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/responses/ApiResponse.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/parameters/RequestBody.java
*
/opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/links/LinkParameter.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/Hidden.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/media/Content.java
```

1.209 swagger 2.1.9

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```
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jar/io/swagger/v3/oas/annotations/security/SecuritySchemes.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/headers/Header.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/responses/ApiResponse.java
*
/opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/media/Encoding.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/Hidden.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
```

jar/io/swagger/v3/oas/annotations/security/OAuthScope.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/media/Schema.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/media/DiscriminatorMapping.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/SecurityRequirement.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/links/Link.java
*
/opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/ExternalDocumentation.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/servers/Servers.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/OAuthFlow.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/servers/Server.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/media/ExampleObject.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/callbacks/Callbacks.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/SecurityRequirements.java
*
/opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/OpenAPIDefinition.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/tags/Tags.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/SecurityScheme.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/info/Info.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/Operation.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/Parameter.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/Parameters.java
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jar/io/swagger/v3/oas/annotations/responses/ApiResponse.java
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* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/extensions/Extensions.java
* /opt/cola/permits/1165124373_1631713413.68/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/servers/ServerVariable.java

1.210 lz4 1.9.2-2ubuntu0.20.04.1

1.210.1 Available under license :

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Upstream-Name: lz4

Source: <https://github.com/Cyan4973/lz4>

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1.211 hibernate 5.4.20.Final

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1.212 libnettle6 3.5.1+really3.5.1-2ubuntu0.2

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Upstream-Name: Nettle

Upstream-Contact: Niels Mller <nisse@lysator.liu.se>

Source: <http://www.lysator.liu.se/~nisse/nettle/>

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.
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.
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.
ARCFOUR

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CAMELLIA

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CAST128

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.
DES

The implementation of the DES cipher is written by Dana L. How, and released under the LGPL.

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MD2

The implementation of MD2 is written by Andrew Kuchling, and hacked some by Andreas Sigfridsson and Niels Miller. Python Cryptography Toolkit license (essentially public domain).

.
MD4

This is almost the same code as for MD5 below, with modifications by Marcus Comstedt. Released into the public domain.

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MD5

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SHA224, SHA256, SHA384, and SHA512

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1.213 swagger-core 2.1.9

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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
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jar/com/google/gson/internal/bind/ObjectTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/MapTypeAdapterFactory.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/TypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/JsonReaderInternalAccess.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/JsonTreeWriter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/TypeAdapterFactory.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/ReflectiveTypeAdapterFactory.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/TypeAdapterRuntimeTypeWrapper.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/PreJava9DateFormatProvider.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/reflect/ReflectionAccessor.java

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*/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/reflect/UnsafeReflectionAccessor.java

* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/JavaVersion.java

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- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonPrimitive.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/ExclusionStrategy.java
- *
- /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonDeserializer.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/\$Gson\$Preconditions.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/Excluder.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonSerializationContext.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonArray.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/annotations/Since.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/Primitives.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/reflect/TypeToken.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/Gson.java
- *
- /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonIOException.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonObject.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonSerializer.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/ObjectConstructor.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonNull.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonDeserializationContext.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonElement.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/GsonBuilder.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldNamingPolicy.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldNamingStrategy.java
- *
- /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/DefaultDateTypeAdapter.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/annotations/Until.java

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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/annotations/SerializedName.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/annotations/Expose.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/InstanceCreator.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/annotations/JsonAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/JsonAdapterAnnotationTypeAdapterFactory.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
```



```
jar/com/google/gson/internal/LazilyParsedNumber.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/SqlDateTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/ConstructorConstructor.java
*
/opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/TimeTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/DateTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/UnsafeAllocator.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
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jar/com/google/gson/internal/$Gson$Types.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonWriter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonScope.java
*
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/MalformedJsonException.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonReader.java
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- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonStreamParser.java
- * /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldAttributes.java
- *
- /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonParser.java

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Data model artifacts for Prometheus.

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package licensing

```
import (  
  "context"  
  "crypto/hmac"  
  "crypto/sha256"  
  "encoding/base64"  
  "encoding/json"  
  "fmt"  
  "time"  
  
  "github.com/docker/libtrust"  
  "github.com/docker/licensing/lib/errors"
```

```

"github.com/docker/licensing/lib/go-clientlib"
"github.com/docker/licensing/model"
)

func (c *client) getLicenseFile(ctx context.Context, subID string) (*model.IssuedLicense, error) {
    url := c.baseURI
    url.Path += fmt.Sprintf("/api/billing/v4/subscriptions/%s/license-file", subID)

    license := new(model.IssuedLicense)
    if _, _, err := c.doReq(ctx, "GET", &url, clientlib.RecvJSON(license)); err != nil {
        return nil, err
    }

    return license, nil
}

// Check verifies that the license identified by the given key id is valid. Note that it does not
// interrogate the contents of the license.
func (c *client) check(ctx context.Context, license model.IssuedLicense) (*model.CheckResponse, error) {
    keyID := license.KeyID
    privateKey := license.PrivateKey

    authorization, err := c.getAuthorization(ctx,
        license)
    if err != nil {
        return nil, err
    }

    // TODO: Mason - replace this parseJWS with a non libtrust lib
    signature, err := libtrust.ParseJWS(authorization)
    if err != nil {
        return nil, errors.Wrapf(err, errors.Fields{
            "key_id": keyID,
        }, "license parse JWS failed")
    }

    keys, err := signature.Verify()
    if err != nil {
        return nil, errors.Wrapf(err, errors.Fields{
            "key_id": keyID,
        }, "license signature verification failed")
    }

    keyCnt := len(keys)
    if keyCnt != 1 {
        err = fmt.Errorf("unexpected number of signing keys (%d)", keyCnt)
        return nil, errors.WithStack(err).With(errors.Fields{
            "key_id": keyID,

```



```

    })
}

key := keys[0]

if !c.recognizedSigningKey(key) {
    return nil, errors.New("unrecognized signing key")
}

payload, err := signature.Payload()
if err != nil {
    return nil, errors.Wrapf(err, errors.Fields{
        "key_id": keyID,
    }, "malformed signature payload")
}

checkRes := new(model.CheckResponse)

err = json.Unmarshal(payload, &checkRes)
if
err != nil {
    return nil, errors.Wrapf(err, errors.Fields{
        "key_id": keyID,
    }, "license payload unmarshal failed")
}

msg := checkRes.Expiration.Format(time.RFC3339)
if err := checkToken(msg, checkRes.Token, privateKey); err != nil {
    return nil, errors.Wrap(err, errors.Fields{
        "key_id": keyID,
    })
}

return checkRes, nil
}

// recognizedSigningKey returns true if the given key is signed with a recognized signing key, false otherwise
func (c *client) recognizedSigningKey(key libtrust.PublicKey) bool {
    for _, publicKey := range c.publicKeys {
        if key.KeyID() == publicKey.KeyID() {
            return true
        }
    }
    return false
}

// getAuthorization returns the decoded license authorization
func (c *client) getAuthorization(ctx context.Context, license model.IssuedLicense) ([]byte, error) {

```

```

decoded, err := base64.StdEncoding.DecodeString(license.Authorization)
if err != nil {
    return nil, errors.Wrapf(err, errors.Fields{
        "key_id": license.KeyID,
    }, "decoding license authorization
failed")
}
return decoded, nil
}

// All of the functions in this file assume that they are receiving a properly
// formatted private key.

// checkToken performs a MAC algorithm (where token is generated by hashing the
// message with the privateKey via GenerateToken) with the purpose of authenticating
// the validity of both the message and the private key of the person who generated
// the token.
func checkToken(message, token, privateKey string) error {
    tokenBytes, err := base64.URLEncoding.DecodeString(token)
    if err != nil {
        return errors.Wrap(err, errors.Fields{"token": token})
    }

    generatedToken, err := generateToken(message, privateKey)
    if err != nil {
        return errors.Wrap(err, errors.Fields{"token": token})
    }

    generatedBytes, err := base64.URLEncoding.DecodeString(generatedToken)
    if err != nil {
        return errors.Wrap(err, errors.Fields{"token": token})
    }

    if !hmac.Equal(tokenBytes, generatedBytes) {
        return errors.Forbidden(errors.Fields{"token": token},
            "invalid token")
    }

    return nil
}

// generateToken generates a hash of the message with the privateKey via the
// sha256 algorithm.
func generateToken(message, privateKey string) (string, error) {
    key, err := base64.URLEncoding.DecodeString(privateKey)
    if err != nil {
        return "", errors.Wrap(err, errors.Fields{"msg": message})
    }

```

```
h := hmac.New(sha256.New, key)
h.Write([]byte(message))
return base64.URLEncoding.EncodeToString(h.Sum(nil)), nil
}
```

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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package model

```
import "time"
```

```
// A CheckResponse is the internal content of the PublicCheckResponse signed  
// json blob.
```

```
type CheckResponse struct {  
    Expiration    time.Time `json:"expiration"`  
    Token         string   `json:"token"`  
    MaxEngines    int      `json:"maxEngines"`  
    ScanningEnabled bool     `json:"scanningEnabled"`  
    Type          string   `json:"licenseType"`  
    Tier          string   `json:"tier"`  
}
```

```
// IssuedLicense represents an issued license
```

```
type IssuedLicense struct {  
    KeyID         string `json:"key_id"`  
    PrivateKey    string `json:"private_key"`  
    Authorization string `json:"authorization"`  
}
```

```
// Valid returns true if the License is syntactically valid, false otherwise
```

```
func (l *IssuedLicense) Valid() (bool, string) {  
    if l.KeyID == "" {
```

```

return false, "empty key_id"
}

if l.PrivateKey == "" {
return false, "empty private_key"
}

if l.Authorization == "" {
return false, "empty authorization"
}

return true, ""
}

```

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package engine

```
import (  
    "time"
```

```
    "github.com/docker/cli/cli/command/formatter"
```

```
    "github.com/docker/cli/internal/licenseutils"
```

```
    "github.com/docker/licensing/model"
```

```
)
```

```
const (
```

```
    defaultSubscriptionsTableFormat = "table"
```

```
    {{{.Num}}}\t{.Owner}}\t{.ProductID}}\t{.Expires}}\t{.ComponentsString}}"
```

```
    defaultSubscriptionsQuietFormat = "{{.Num}}:{{.Summary}}"
```

```
    numHeader          = "NUM"
```

```
    ownerHeader        = "OWNER"
```

```
    licenseNameHeader  = "NAME"
```

```
    idHeader           = "ID"
```

```
    dockerIDHeader     = "DOCKER ID"
```

```
    productIDHeader    = "PRODUCT ID"
```

```
    productRatePlanHeader = "PRODUCT RATE PLAN"
```

```
    productRatePlanIDHeader = "PRODUCT RATE PLAN ID"
```

```
    startHeader        = "START"
```

```

expiresHeader      = "EXPIRES"
stateHeader        = "STATE"
eusaHeader         = "EUSA"
pricingComponentsHeader = "PRICING COMPONENTS"
)

// NewSubscriptionsFormat returns a Format for rendering using a license Context
func NewSubscriptionsFormat(source string, quiet bool) formatter.Format
{
switch source {
case formatter.TableFormatKey:
if quiet {
return defaultSubscriptionsQuietFormat
}
return defaultSubscriptionsTableFormat
case formatter.RawFormatKey:
if quiet {
return `license: {{.ID}}`
}
return `license: {{.ID}}\nname: {{.Name}}\nowner: {{.Owner}}\ncomponents: {{.ComponentsString}}\n`
}
return formatter.Format(source)
}

// SubscriptionsWrite writes the context
func SubscriptionsWrite(ctx formatter.Context, subs []licenseutils.LicenseDisplay) error {
render := func(format func(subContext formatter.SubContext) error) error {
for _, sub := range subs {
licenseCtx := &licenseContext{trunc: ctx.Trunc, l: sub}
if err := format(licenseCtx); err != nil {
return err
}
}
return nil
}
licenseCtx := licenseContext{}
licenseCtx.Header = map[string]string{
"Num":      numHeader,
"Owner":    ownerHeader,
"Name":     licenseNameHeader,
"ID":       idHeader,
"DockerID": dockerIDHeader,
"ProductID":
productIDHeader,
"ProductRatePlan": productRatePlanHeader,
"ProductRatePlanID": productRatePlanIDHeader,
"Start":    startHeader,
"Expires":  expiresHeader,

```

```

"State":      stateHeader,
"Eusa":      eusaHeader,
"ComponentsString": pricingComponentsHeader,
}
return ctx.Write(&licenseCtx, render)
}

type licenseContext struct {
formatter.HeaderContext
trunc bool
l licenseutils.LicenseDisplay
}

func (c *licenseContext) MarshalJSON() ([]byte, error) {
return formatter.MarshalJSON(c)
}

func (c *licenseContext) Num() int {
return c.l.Num
}

func (c *licenseContext) Owner() string {
return c.l.Owner
}

func (c *licenseContext) ComponentsString() string {
return c.l.ComponentsString
}

func (c *licenseContext) Summary() string {
return c.l.String()
}

func (c *licenseContext) Name() string {
return c.l.Name
}

func (c *licenseContext) ID() string {
return c.l.ID
}

func (c *licenseContext) DockerID()
string {
return c.l.DockerID
}

func (c *licenseContext) ProductID() string {
return c.l.ProductID
}

```

```

}

func (c *licenseContext) ProductRatePlan() string {
    return c.l.ProductRatePlan
}

func (c *licenseContext) ProductRatePlanID() string {
    return c.l.ProductRatePlanID
}

func (c *licenseContext) Start() *time.Time {
    return c.l.Start
}

func (c *licenseContext) Expires() *time.Time {
    return c.l.Expires
}

func (c *licenseContext) State() string {
    return c.l.State
}

func (c *licenseContext) Eusa() *model.EusaState {
    return c.l.Eusa
}

func (c *licenseContext) PricingComponents() []model.SubscriptionPricingComponent {
    // Dereference the pricing component pointers in the pricing components
    // so it can be rendered properly with the template formatter

    var ret []model.SubscriptionPricingComponent
    for _, spc := range c.l.PricingComponents {
        if spc == nil {
            continue
        }
        ret = append(ret, *spc)
    }
    return ret
}

```

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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package engine

```
import (  
  "bytes"  
  "encoding/json"  
  "strings"  
  "testing"  
  "time"
```

```
"github.com/docker/cli/cli/command/formatter"
```

```
"github.com/docker/cli/internal/licenseutils"
```

```
"github.com/docker/licensing/model"
"gotest.tools/assert"
is "gotest.tools/assert/cmp"
)
```

```
func TestSubscriptionContextWrite(t *testing.T) {
cases := []struct {
context formatter.Context
expected string
}{
// Errors
{
formatter.Context{Format: "{{InvalidFunction}}"},
`Template parsing error: template: :1: function "InvalidFunction" not defined
`,
},
{
formatter.Context{Format: "{{nil}}"},
`Template parsing error: template: :1:2: executing "" at <nil>: nil is not a command
`,
},
// Table format
{
formatter.Context{Format: NewSubscriptionsFormat("table", false)},
`NUM          OWNER          PRODUCT ID    EXPIRES          PRICING COMPONENTS
1            owner1          productid1    2020-01-01 10:00:00 +0000 UTC  compstring
2
            owner2          productid2    2020-01-01 10:00:00 +0000 UTC  compstring
`,
},
{
formatter.Context{Format: NewSubscriptionsFormat("table", true)},
`1:License Name: name1 Quantity: 10 nodes Expiration date: 2020-01-01
2:License Name: name2 Quantity: 20 nodes Expiration date: 2020-01-01
`,
},
{
formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", false)},
`OWNER
owner1
owner2
`,
},
{
formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", true)},
`OWNER
owner1
owner2
`
}
```

```

`,
},
// Raw Format
{
  formatter.Context{Format: NewSubscriptionsFormat("raw", false)},
  `license: id1
name: name1
owner: owner1
components: compstring

license: id2
name: name2
owner: owner2
components: compstring

`,
},
{
  formatter.Context{Format: NewSubscriptionsFormat("raw", true)},
  `license: id1
license: id2
`,
},
// Custom Format
{
  formatter.Context{Format: NewSubscriptionsFormat("{{.Owner}}", false)},
  `owner1
owner2
`,
},
}

expiration,
_ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")

for _, testcase := range cases {
subscriptions := []licenseutils.LicenseDisplay{
{
  Num: 1,
  Owner: "owner1",
  Subscription: model.Subscription{
    ID: "id1",
    Name: "name1",
    ProductID: "productid1",
    Expires: &expiration,
    PricingComponents: model.PricingComponents{
      &model.SubscriptionPricingComponent{
        Name: "nodes",

```



```

    Value: 10,
  },
},
},
ComponentsString: "compstring",
},
{
  Num: 2,
  Owner: "owner2",
  Subscription: model.Subscription{
    ID: "id2",
    Name: "name2",
    ProductID: "productid2",
    Expires: &expiration,
    PricingComponents: model.PricingComponents{
      &model.SubscriptionPricingComponent{
        Name: "nodes",
        Value: 20,
      },
    },
  },
  ComponentsString: "compstring",
},
}
out := &bytes.Buffer{}
testcase.context.Output
= out
err := SubscriptionsWrite(testcase.context, subscriptions)
if err != nil {
  assert.Error(t, err, testcase.expected)
} else {
  assert.Check(t, is.Equal(testcase.expected, out.String()))
}
}
}

func TestSubscriptionContextWriteJSON(t *testing.T) {
  expiration, _ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")
  subscriptions := []licenseutils.LicenseDisplay{
    {
      Num: 1,
      Owner: "owner1",
      Subscription: model.Subscription{
        ID: "id1",
        Name: "name1",
        ProductID: "productid1",
        Expires: &expiration,
        PricingComponents: model.PricingComponents{

```

```

&model.SubscriptionPricingComponent{
  Name: "nodes",
  Value: 10,
},
},
},
ComponentsString: "compstring",
},
{
  Num: 2,
  Owner: "owner2",
  Subscription: model.Subscription{
    ID: "id2",
    Name: "name2",
    ProductID: "productid2",
    Expires: &expiration,
    PricingComponents: model.PricingComponents{
      &model.SubscriptionPricingComponent{
        Name:
"nodes",
        Value: 20,
      },
    },
  },
  ComponentsString: "compstring",
},
}
expectedJSONs := []map[string]interface{}{
{
  "Owner": "owner1",
  "ComponentsString": "compstring",
  "Expires": "2020-01-01T10:00:00Z",
  "DockerID": "",
  "Eusa": nil,
  "ID": "id1",
  "Start": nil,
  "Name": "name1",
  "Num": float64(1),
  "PricingComponents": []interface{}{
    map[string]interface{}{
      "name": "nodes",
      "value": float64(10),
    },
  },
  "ProductID": "productid1",
  "ProductRatePlan": "",
  "ProductRatePlanID": "",
  "State": "",
}
}

```

```

"Summary":      "License Name: name1\tQuantity: 10 nodes\tExpiration date: 2020-01-01",
},
{
"Owner":      "owner2",
"ComponentsString": "compstring",
"Expires":    "2020-01-01T10:00:00Z",
"DockerID":   "",
"Eusa":      nil,
"ID":
    "id2",
"Start":     nil,
"Name":      "name2",
"Num":      float64(2),
"PricingComponents": []interface{}{
    map[string]interface{}{
        "name": "nodes",
        "value": float64(20),
    },
},
"ProductID":    "productid2",
"ProductRatePlan": "",
"ProductRatePlanID": "",
"State":      "",
"Summary":      "License Name: name2\tQuantity: 20 nodes\tExpiration date: 2020-01-01",
},
}

```

```

out := &bytes.Buffer{ }
err := SubscriptionsWrite(formatter.Context{Format: "{{json .}}", Output: out}, subscriptions)
if err != nil {
    t.Fatal(err)
}
for i, line := range strings.Split(strings.TrimSpace(out.String()), "\n") {
    var m map[string]interface{}
    if err := json.Unmarshal([]byte(line), &m); err != nil {
        t.Fatal(err)
    }
    assert.Check(t, is.DeepEqual(expectedJSONs[i], m))
}
}

```

```

func TestSubscriptionContextWriteJSONField(t *testing.T) {
    subscriptions := []licenseutils.LicenseDisplay{
        {Num: 1, Owner:
            "owner1"},
        {Num: 2, Owner: "owner2"},
    }
    out := &bytes.Buffer{ }

```

```

err := SubscriptionsWrite(formatter.Context{Format: "{{json .Owner}}", Output: out}, subscriptions)
if err != nil {
    t.Fatal(err)
}
for i, line := range strings.Split(strings.TrimSpace(out.String()), "\n") {
    var s string
    if err := json.Unmarshal([]byte(line), &s); err != nil {
        t.Fatal(err)
    }
    assert.Check(t, is.Equal(subscriptions[i].Owner, s))
}
}

```

1.218 procps 3.2.8

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1.219 activation 1.1

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Abe Haskins <abeisgreat@abeisgreat.com>
```

Abhinav Gupta <abhinav.g90@gmail.com>
Adam Langley <agl@golang.org>
Adrian Nos <nos.adrian@gmail.com>
Adrian O'Grady <elpollouk@gmail.com>
Adrien Bustany <adrien-xx-google@bustany.org>
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Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>
Aleksandar Dezelin <dezelin@gmail.com>
Alessandro Arzilli <alessandro.arzilli@gmail.com>
Alessandro Baffa <alessandro.baffa@gmail.com>
Alex A Skinner <alex@lx.lc>
Alex Brainman <alex.brainman@gmail.com>
Alex Bramley <abramley@google.com>
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Alex Schroeder <alex@gnu.org>
Alex Sergeyev <abc@alexsergeyev.com>
Alex Vaghin <crhyme@google.com>
Alexander
Demakin <alexander.demakin@gmail.com>
Alexander Dring <email@alex.d.ch>
Alexander Larsson <alexander.larsson@gmail.com>
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Alexandre Normand <alexandre.normand@gmail.com>
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Alexei Sholik <alcosholik@gmail.com>
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Nathan <andrenth@gmail.com>
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Andreas Litt <andreas.litt@gmail.com>
Andrei Korzhevskii <a.korzhevskiy@gmail.com>
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Andrew Austin <andrewacht@gmail.com>
Andrew Balholm <andybalholm@gmail.com>
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Andrew Harding <andrew@spacemonkey.com>
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Andrew Pilloud <andrewpilloud@igneoussystem.com>
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Williams <williams.andrew@gmail.com>
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Angelo Bulfone <mbulfone@gmail.com>
Anh Hai Trinh <anh.hai.trinh@gmail.com>
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Anthony Canino <anthony.canino1@gmail.com>
Anthony Eufemio <anthony.eufemio@gmail.com>
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Lehr <Berengar.Lehr@gmx.de>
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Billie Harold Cleek <bhcleek@gmail.com>
Billy Lynch <wlynch@google.com>
Bjorn Tillenius <bjorn@tillenius.me>
Bjorn Tipling <bjorn.tipling@gmail.com>
Blake Gentry <blakesgentry@gmail.com>
Blake Mizerany <blake.mizerany@gmail.com>
Blixt <me@blixt.nyc>
Bobby Powers <bobbypowers@gmail.com>
Boris Nagaev <nagaev@google.com>
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>
Brad Garcia <bgarcia@golang.org>
Braden Bassingthwaite <bbassingthwaite@vendasta.com>
Brady Catherman <brady@gmail.com>
Brady Sullivan <brady@bsull.com>
Brandon Gilmore <varz@google.com>
Brendan Daniel Tracey <tracey.brendan@gmail.com>
Brendan O'Dea <bod@golang.org>
Brett Cannon <bcannon@gmail.com>
Brian Dellisanti <briandellisanti@gmail.com>
Brian G. Merrell <bgmerrell@gmail.com>
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com>
<bgm@google.com>
Brian Kennedy <btkennedy@gmail.com>
Brian Ketelsen <bketelsen@gmail.com>
Brian Slesinsky <skybrian@google.com>
Brian Smith <ohohvi@gmail.com>
Bryan Alexander <Kozical@msn.com>
Bryan C. Mills <bcmills@google.com>
Bryan Chan <bryan.chan@ca.ibm.com>
Bryan Ford <brynosaurus@gmail.com>
Caine Tighe <arctanofyourface@gmail.com>
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>
Caleb Spare <cespare@gmail.com>
Carl Chatfield <carlchatfield@gmail.com>
Carl Jackson <carl@stripe.com>
Carl Johnson <me@carlmjohnson.net>
Carl Mastrangelo <notcarl@google.com>
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>
Carlos Castillo <cookieo9@gmail.com>
Carlos Cirello <uldericofilho@gmail.com>
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>
Cary Hull <chull@google.com>
Case Nelson <case.nelson@gmail.com>
Casey Marshall <casey.marshall@gmail.com>

Catalin Nicutar <cnicutar@google.com>
Catalin Patulea <catalinp@google.com>
Cedric Staub <cs@squareup.com>
Cezar S Espinola <cezarsa@gmail.com>
ChaiShushan
<chaishushan@gmail.com>
Charles L. Dorian <cldorian@gmail.com>
Charles Lee <zombie.fml@gmail.com>
Charles Weill <weill@google.com>
Cherry Zhang <cherryz@google.com>
Chris Broadfoot <cbro@golang.org>
Chris Dollin <ehog.hedge@gmail.com>
Chris Farmiloe <chrisfarms@gmail.com>
Chris Hines <chris.cs.guy@gmail.com>
Chris Howey <howeyc@gmail.com>
Chris Hundt <hundt@google.com>
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>
Chris Kastorff <encryptio@gmail.com>
Chris Lennert <calennert@gmail.com>
Chris Manghane <cmang@golang.org>
Chris McGee <sirnewton_01@yahoo.ca> <newton688@gmail.com>
Chris Stockton <chrisstocktonaz@gmail.com>
Chris Zou <chriszou@ca.ibm.com>
Christian Couder <chriscool@tuxfamily.org>
Christian Himpel <chressie@googlemail.com> <chressie@gmail.com>
Christine Hansmann <chhansmann@gmail.com>
Christoffer Buchholz <christoffer.buchholz@gmail.com>
Christoph Hack <christoph@tux21b.org>
Christopher Cahoon <chris.cahoon@gmail.com>
Christopher Guiney
<chris@guiney.net>
Christopher Nelson <nadiasvertex@gmail.com>
Christopher Nielsen <m4dh4tt3r@gmail.com>
Christopher Redden <christopher.redden@gmail.com>
Christopher Swenson <cswenson@google.com>
Christopher Wedgwood <cw@f00f.org>
Christy Perez <christy@linux.vnet.ibm.com>
CL Sung <clsung@gmail.com> <cl_sung@htc.com>
Clement Skau <clementskau@gmail.com>
Colby Ranger <cranger@google.com>
Colin Cross <ccross@android.com>
Colin Edwards <colin@recursivepenguin.com>
Colin Kennedy <moshen.colin@gmail.com>
Conrad Irwin <conrad.irwin@gmail.com>
Conrad Meyer <cemeyer@cs.washington.edu>
Corey Thomasson <cthom.lists@gmail.com>
Cosmos Nicolaou <cnicolaou@google.com>
Cristian Staretu <unclejacksons@gmail.com>

Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>
Cyrill Schumacher <cyrill@schumacher.fm>
Damian Gryski <dgryski@gmail.com>
Damien Neil <dneil@google.com>
Dan Caddigan <goldcaddy77@gmail.com>
Dan Callahan <dan.callahan@gmail.com>
Dan Harrington <harringtond@google.com>
Dan Jacques <dnj@google.com>
Dan
Peterson <dpiddy@gmail.com>
Dan Pupius <dan@medium.com>
Dan Sinclair <dan.sinclair@gmail.com>
Daniel Fleischman <danielfleischman@gmail.com>
Daniel Johansson <dajo2002@gmail.com>
Daniel Kerwin <d.kerwin@gini.net>
Daniel Krech <eikeon@eikeon.com>
Daniel Lidn <daniel.liden.87@gmail.com>
Daniel Mart <mvdan@mvdan.cc>
Daniel Morsing <daniel.morsing@gmail.com>
Daniel Nadasi <dnadasi@google.com>
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>
Daniel Skinner <daniel@dasa.cc>
Daniel Speichert <daniel@speichert.pl>
Daniel Theophanes <kardianos@gmail.com>
Daria Koliustratova <daria.kolistratova@intel.com>
Darren Elwood <darren@textnode.com>
Datong Sun <dndx@idndx.com>
Dave Borowitz <dborowitz@google.com>
Dave Bort <dbort@golang.org>
Dave Cheney <dave@cheney.net>
Dave Day <djd@golang.org>
Dave Grijalva <dgrijalva@ngmoco.com>
David Anderson <danderson@google.com>
David Barnett <dbarnett@google.com>
David Benjamin <davidben@google.com>
David Brophy <dave@brophy.uk>
David
Brgin <676c7473@gmail.com>
David Calavera <david.calavera@gmail.com>
David Chase <drchase@google.com>
David Covert <davidhcovert@gmail.com>
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>
David du Colombier <0intro@gmail.com>
David Forsythe <dforsythe@gmail.com>
David G. Andersen <dave.andersen@gmail.com>
David Glasser <glasser@meteor.com>
David Howden <dhowden@gmail.com>
David Hubbard <dsp@google.com>

David Jakob Fritz <david.jakob.fritz@gmail.com>
David Lazar <lazard@golang.org>
David Leon Gil <coruus@gmail.com>
David McLeish <davemc@google.com>
David Presotto <presotto@gmail.com>
David R. Jenni <david.r.jenni@gmail.com>
David Sansome <me@davidsansome.com>
David Stainton <dstainton415@gmail.com>
David Symonds <dsymonds@golang.org>
David Thomas <davidthomas426@gmail.com>
David Titarenco <david.titarenco@gmail.com>
Davies Liu <davies.liu@gmail.com>
Dean Prichard <dean.prichard@gmail.com>
Deepak Jois <deepak.jois@gmail.com>
Denis Bernard <db047h@gmail.com>
Denis
Brandolini <denis.brandolini@gmail.com>
Denis Nagorny <denis.nagorny@intel.com>
Denys Honsiorovskyi <honsiorovskyi@gmail.com>
Derek Buitenhuis <derek.buitenhuis@gmail.com>
Derek Che <drc@yahoo-inc.com>
Derek Parker <parkerderek86@gmail.com>
Derek Shockey <derek.shockey@gmail.com>
Devon H. O'Dell <devon.odell@gmail.com>
Dhaivat Pandit <dhaivatpandit@gmail.com>
Dhananjay Nakrani <dhananjayn@google.com>
Dhiru Kholia <dhiru.kholia@gmail.com>
Didier Spezia <didier.06@gmail.com>
Dimitri Tcaciuc <dtcaciuc@gmail.com>
Dirk Gadsden <dirk@esherido.com>
Diwaker Gupta <diwakergupta@gmail.com>
Dmitri Popov <operator@cv.dp-net.com>
Dmitri Shuralyov <shurcool@gmail.com>
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>
Dmitriy Vyukov <dvyukov@google.com>
Dmitry Chestnykh <dchest@gmail.com>
Dmitry Savintsev <dsavints@gmail.com>
Dmitry Yakunin <nonamezeil@gmail.com>
Dominik Honnef <dominik.honnef@gmail.com>
Dominik Vogt <vogt@linux.vnet.ibm.com>
Donald
Huang <don.hcd@gmail.com>
Donovan Hide <donovanhide@gmail.com>
Doug Anderson <douga@google.com>
Drew Hintz <adhintz@google.com>
Duncan Holm <mail@frou.org>
Dustin Carlino <dcarlino@google.com>

Dustin Herbison <djherbis@gmail.com>
Dustin Long <dustmop@gmail.com>
Dustin Sallings <dsallings@gmail.com>
Dustin Shields-Cloues <dcloues@gmail.com>
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>
Eden Li <eden.li@gmail.com>
Edward Muller <edwardam@interlix.com>
Egon Elbre <egonelbre@gmail.com>
Ehren Kret <ehren.kret@gmail.com>
Eivind Uggedal <eivind@uggedal.com>
Elias Naur <elias.naur@gmail.com>
Elliot Morrison-Reed <elliottmr@gmail.com>
Emil Hessman <c.emil.hessman@gmail.com> <emil@hessman.se>
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>
Eoghan Sherry <ejsherry@gmail.com>
Eric Clark <zerohp@gmail.com>
Eric Engestrom <eric@engestrom.ch>
Eric Garrido <ekg@google.com>
Eric Koleda <ekoleda+devrel@google.com>
Eric Lagergren <ericscottlagergren@gmail.com>
Eric Milliken
<emilliken@gmail.com>
Eric Roshan-Eisner <eric.d.eisner@gmail.com>
Erik Aigner <aigner.erik@gmail.com>
Erik Dubbelboer <erik@dubbelboer.com>
Erik St. Martin <alakriti@gmail.com>
Erik Staab <estaab@google.com>
Erik Westrup <erik.westrup@gmail.com>
Ernest Chiang <ernest_chiang@htc.com>
Esko Luontola <esko.luontola@gmail.com>
Ethan Burns <eaburns@google.com>
Ethan Miller <eamiller@us.ibm.com>
Euan Kemp <euank@euank.com>
Evan Broder <evan@stripe.com>
Evan Brown <evanbrown@google.com>
Evan Kroske <evankroske@google.com>
Evan Martin <evan.martin@gmail.com>
Evan Phoenix <evan@phx.io>
Evan Shaw <chickencha@gmail.com>
Ewan Chou <coocood@gmail.com>
Fabian Wickborn <fabian@wickborn.net>
Fabrizio Milo <mistobaan@gmail.com>
Faiyaz Ahmed <ahmedf@vmware.com>
Fan Hongjian <fan.howard@gmail.com>
Fatih Arslan <fatih@arslan.io>
Fazlul Shahriar <fshahriar@gmail.com>
Federico Simoncelli <fsimonce@redhat.com>
Fedor Indutny <fedor@indutny.com>

Felix Geisendrfer <haimuiba@gmail.com>
Filippo Valsorda <hi@filippo.io>
Firmansyah
Adiputra <frm.adiputra@gmail.com>
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>
Florian Weimer <fw@deneb.enyo.de>
Florin Patan <florinpatan@gmail.com>
Folke Behrens <folke@google.com>
Ford Hurley <ford.hurley@gmail.com>
Francesc Campoy <campoy@golang.org>
Francisco Claude <fclaude@recoded.cl>
Francisco Souza <franciscossouza@gmail.com>
Frederick Kelly Mayle III <frederickmayle@gmail.com>
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>
Frits van Bommel <fvbommel@gmail.com>
Fumitoshi Ukai <ukai@google.com>
Gaal Yahas <gaal@google.com>
Gabriel Aszalos <gabriel.aszalos@gmail.com>
Gabriel Russell <gabriel.russell@gmail.com>
Gareth Paul Jones <gpj@foursquare.com>
Garrick Evans <garrick@google.com>
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>
Gary Elliott <garyelliott@google.com>
Gaurish Sharma <contact@aurishsharma.com>
Gautham Thambidorai <gautham.dorai@gmail.com>
Geert-Johan
Riemer <gjr19912@gmail.com>
Geoffroy Lorieux <lorieux.g@gmail.com>
Georg Reinke <guelfey@gmail.com>
George Shammass <george@shamm.as> <georgyo@gmail.com>
Gerasimos Dimitriadis <gedimitr@gmail.com>
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>
Giles Lean <giles.lean@pobox.com>
Giovanni Bajo <rasky@develer.com>
Giulio Iotti <dullgiulio@gmail.com>
Gleb Stepanov <glebstepanov1992@gmail.com>
Glenn Brown <glennb@google.com>
Glenn Lewis <gmlewis@google.com>
Gordon Klaus <gordon.klaus@gmail.com>
Graham King <graham4king@gmail.com>
Graham Miller <graham.miller@gmail.com>
Greg Ward <greg@gerg.ca>
Guillaume J. Charmes <guillaume@charm.es.net>
Guobiao Mei <meiguobiao@gmail.com>
Gustav Paul <gustav.paul@gmail.com>
Gustavo Franco <gustavorfranco@gmail.com>
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>

Gwenael Treguier <gwenn.kahz@gmail.com>
Gyu-Ho Lee <gyuhox@gmail.com>
H. brahim Gngr <igungor@gmail.com>
Hajime Hoshi <hajimehoshi@gmail.com>
Hallgrimur Gunnarsson
<halg@google.com>
Han-Wen Nienhuys <hanwen@google.com>
Hari haran <hariharan.uno@gmail.com>
Hariharan Srinath <srinathh@gmail.com>
Harley Laue <losinggeneration@gmail.com>
Harry Moreno <morenoh149@gmail.com>
Harshavardhana <hrshvardhana@gmail.com>
Hvard Haugen <havard.haugen@gmail.com>
Hector Chu <hectorchu@gmail.com>
Hector Martin Cantero <hector@marcansoft.com>
Henning Schmiedehausen <henning@schmiedehausen.org>
Henrik Edwards <henrik.edwards@gmail.com>
Henrik Hodne <henrik@hodne.io>
Herbert Georg Fischer <herbert.fischer@gmail.com>
Hironao OTSUBO <motemen@gmail.com>
Hiroshi Ioka <hirochachacha@gmail.com>
Hitoshi Mitake <mitake.hitoshi@gmail.com>
Holden Huang <ttyh061@gmail.com>
Hong Ruiqi <hongruiqi@gmail.com>
Hossein Sheikh Attar <hattar@google.com>
Hsin-Ho Yeh <yhh92u@gmail.com>
Hu Keping <hukeping@huawei.com>
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>
Ian Gudger <ian@loosescre.ws>
Ian Lance Taylor <iant@golang.org>
Icarus Sparry <golang@icarus.freeuk.com>
Idora
Shinatose <idora.shinatose@gmail.com>
Igor Bernstein <igorbernstein@google.com>
Igor Dolzhikov <bluesriverz@gmail.com>
Ilya Tocar <ilya.tocar@intel.com>
INADA Naoki <songofacandy@gmail.com>
Ingo Krabbe <ikrabbe.ask@gmail.com>
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>
Irieda Noboru <irieda@gmail.com>
Isaac Wagner <ibw@isaacwagner.me>
Ivan Babrou <ivan@cloudflare.com>
Ivan Krasin <krasin@golang.org>
Ivan Ukhov <ivan.ukhov@gmail.com>
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>
Jack Lindamood <jlindamo@justin.tv>
Jacob Baskin <jbaskin@google.com>
Jacob H. Haven <jacob@cloudflare.com>

Jacob Hoffman-Andrews <github@hoffman-andrews.com>
Jae Kwon <jae@tendermint.com>
Jakob Borg <jakob@nym.se>
Jakub ajka <jcajka@redhat.com>
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>
James Aguilar <jaguilar@google.com>
James Bardin <j.bardin@gmail.com>
James Chacon <jchacon@google.com>
James Clarke <jrtc27@jrtc27.com>
James David Chalfant <james.chalfant@gmail.com>
James
Fysh <james.fysh@gmail.com>
James Gray <james@james4k.com>
James Meneghello <rawrz0r@gmail.com>
James P. Cooper <jamespcooper@gmail.com>
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>
James Schofield <james@shoeboxapp.com>
James Sweet <james.sweet88@googlemail.com>
James Toy <nil@opensesame.st>
James Tucker <raggi@google.com>
James Whitehead <jnwhiteh@gmail.com>
Jamie Beverly <jamie.r.beverly@gmail.com>
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>
Jamie Turner <jamwt@dropbox.com>
Jamie Wilkinson <jaq@spacepants.org>
Jamil Djadala <djadala@gmail.com>
Jan H. Hosang <jan.hosang@gmail.com>
Jan Kratochvil <jan.kratochvil@redhat.com>
Jan Mercl <0xjnml@gmail.com>
Jan Mercl <befelemepeseveze@gmail.com>
Jan Newmarch <jan.newmarch@gmail.com>
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>
Jaroslavas Poepko <jp@webmaster.ms>
Jason Barnett <jason.w.barnett@gmail.com>
Jason Buberel <jbuberel@google.com>
Jason
Del Ponte <delpontej@gmail.com>
Jason Hall <jasonhall@google.com>
Jason Smale <jsmale@zendesk.com>
Jason Travis <infomaniac7@gmail.com>
Jay Weisskopf <jay@jayschwa.net>
Jean-Marc Eurin <jmeurin@google.com>
Jean-Nicolas Moal <jn.moal@gmail.com>
Jed Denlea <jed@fastly.com>
Jeff Craig <jeffcraig@google.com>
Jeff Hodges <jeff@somethingsimilar.com>
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>

Jeff Sickel <jas@corpus-callosum.com>
Jeff Wendling <jeff@spacemonkey.com>
Jens Frederich <jfrederich@gmail.com>
Jeremiah Harmsen <jeremiah@google.com>
Jeremy Jackins <jeremyjackins@gmail.com>
Jeremy Schlatter <jeremy.schlatter@gmail.com>
Jeroen Bobbeldijk <jerbob92@gmail.com>
Jess Frazelle <me@jessfraz.com>
Jesse Szwedko <jesse.szwedko@gmail.com>
Jihyun Yu <yjh0502@gmail.com>
Jim Cote <jfcote87@gmail.com>
Jim Kingdon <jim@bolt.me>
Jim McGrath <jimmc2@gmail.com>
Jimmy Zelinskie <jimmyzelinskie@gmail.com>
Jingcheng Zhang <diogin@gmail.com>
Jingguo Yao <yaojingguo@gmail.com>
Jiong Du <londevil@gmail.com>
Jirka
Dank <dnk@mail.muni.cz>
Joakim Sernbrant <serbaut@gmail.com>
Joe Farrell <joe2farrell@gmail.com>
Joe Harrison <joehazzers@gmail.com>
Joe Henke <joed.henke@gmail.com>
Joe Poirier <jdpoirier@gmail.com>
Joe Shaw <joe@joeshaw.org>
Joe Sylve <joe.sylve@gmail.com>
Joe Tsai <joetsai@digital-static.net>
Joel Sing <jsing@google.com>
Joel Stemmer <stemmertech@gmail.com>
Johan Euphrosine <proppy@google.com>
Johan Sageryd <j@1616.se>
John Asmuth <jasmuth@gmail.com>
John Beisley <huin@google.com>
John C Barstow <jbowtie@amathaine.com>
John DeNero <denero@google.com>
John Dethridge <jcd@golang.org>
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>
John Howard Palevich <jack.palevich@gmail.com>
John Jeffery <jjeffery@sp.com.au>
John Jenkins <twodopeshaggy@gmail.com>
John Newlin <jnewlin@google.com>
John Potocny <johnp@vividcortex.com>
John Schnake <schnake.john@gmail.com>
John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
Jon Chen <jchen@justin.tv>
Jonathan Allie

<jonallie@google.com>
Jonathan Amsterdam <jba@google.com>
Jonathan Boulle <jonathanboulle@gmail.com>
Jonathan Feinberg <feinberg@google.com>
Jonathan Gold <jgold.bg@gmail.com>
Jonathan Hseu <jhseu@google.com>
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>
Jonathan Nieder <jrn@google.com>
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>
Jonathan Rudenberg <jonathan@titanous.com>
Jonathan Wills <runningwild@gmail.com>
Jongmin Kim <atomaths@gmail.com>
Joonas Kuorilehto <joneskoo@derbian.fi>
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>
Jordan Lewis <jordanthelewis@gmail.com>
Jos Visser <josv@google.com>
Jose Luis Vazquez Gonzalez <josvazg@gmail.com>
Joseph Bonneau <jcb@google.com>
Joseph Holsten <joseph@josephholsten.com>
Josh Bleecher Snyder <josharian@gmail.com>
Josh Chorlton <jchorlton@gmail.com>
Josh Goebel <dreamer3@gmail.com>
Josh Hoak <jhoak@google.com>
Josh Holland <jrh@joshh.co.uk>
Joshua Boelter <joshua.boelter@intel.com>
Joshua Chase <jcjosuachase@gmail.com>
Jostein
Stuhaug <js@solidsystem.no>
JP Sugarbroad <jpsugar@google.com>
JT Olds <jtolds@xnet5.com>
Jukka-Pekka Kekkonen <karatepekka@gmail.com>
Julia Hansbrough <flowerhack@google.com>
Julian Kornberger <jk+github@digineo.de>
Julian Phillips <julian@quantumfyre.co.uk>
Julien Schmidt <google@julienschmidt.com>
Jungho Ahn <jhahn@google.com>
Jure Ham <jure.ham@zemanta.com>
Justin Nu <nuss.justin@gmail.com>
Justyn Temme <justyntemme@gmail.com>
Kai Backman <kaib@golang.org>
Kale Blankenship <kale@lemnisis.com>
Kamal Aboul-Hosn <aboulhosn@google.com>
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>
Kang Hu <hukangustc@gmail.com>
Karan Dhiman <karandhi@ca.ibm.com>
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>
Katrina Owen <katrina.owen@gmail.com>
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>

Kay Zhu <kayzhu@google.com>
KB Sriram <kbsriram@google.com>
Keegan Carruthers-Smith <keegan.csmith@gmail.com>
Kei Son <hey.calmdown@gmail.com>
Keith Ball <inflatablewoman@gmail.com>
Keith
Randall <khr@golang.org>
Keith Rarick <kr@xph.us>
Kelsey Hightower <kelsey.hightower@gmail.com>
Kelvin Foo Chuan Lyi <vmirage@gmail.com>
Ken Friedenbach <kenliz@cruzio.com>
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>
Ken Sedgwick <ken@bonsai.com>
Ken Thompson <ken@golang.org>
Kenji Kaneda <kenji.kaneda@gmail.com>
Kenneth Shaw <kenshaw@gmail.com>
Kenny Grant <kennygrant@gmail.com>
Kevin Ballard <kevin@sb.org>
Kevin Burke <kev@inburke.com>
Kevin Kirsche <kev.kirsche@gmail.com>
Kevin Klues <klueska@gmail.com> <klueska@google.com>
Kevin Malachowski <chowski@google.com>
Kevin Vu <kevin.m.vu@gmail.com>
Kim Shrier <kshrier@racktopsystems.com>
Kirklin McDonald <kirklin.mcdonald@gmail.com>
Klaus Post <klauspost@gmail.com>
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>
Kris Rousey <krousey@google.com>
Kristopher Watts <traetox@gmail.com>
Kun Li <likunarmstrong@gmail.com>
Kyle Consalus <consalus@gmail.com>
Kyle Isom <kyle@gokyle.net>
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>

L

Campbell <unpantsu@gmail.com>
Lai Jiangshan <eag0628@gmail.com>
Larry Hosken <lahosken@golang.org>
Larz Conwell <larzconwell@gmail.com>
LE Manh Cuong <cuong.manhle.vn@gmail.com>
Lee Hinman <hinman@gmail.com>
Lee Packham <lpackham@gmail.com>
Lewin Bormann <lewin.bormann@gmail.com>
Lloyd Dewolf <foolswisdom@gmail.com>
Lorenzo Stoakes <lstoakes@gmail.com>
Louis Kruger <louisk@google.com>
Luan Santos <cfcluan@gmail.com>
Luca Greco <luca.greco@alcacoop.it>
Lucien Stuker <lucien.stuker@gmail.com>

Lucio De Re <lucio.dere@gmail.com>
Luigi Riefolo <luigi.riefolo@gmail.com>
Luit van Drongelen <luitvd@gmail.com>
Luka Zakrajek <tr00.g33k@gmail.com>
Luke Curley <qpingu@gmail.com>
Luna Duclos <luna.duclos@palmstonegames.com>
Luuk van Dijk <lvd@golang.org> <lvd@google.com>
Lynn Boger <laboger@linux.vnet.ibm.com>
Maksym Trykur <maksym.trykur@gmail.com>
Mal Curtis <mal@mal.co.nz>
Manfred Touron <m@42.am>
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>
Manu Garg <manugarg@google.com>
Manu
S Ajith <neo@codingarena.in>
Manuel Mendez <mmendez534@gmail.com>
Marc Weistroff <marc@weistroff.net>
Marc-Antoine Ruel <maruel@chromium.org>
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>
Marcel van Lohuizen <mpvl@golang.org>
Marco Hennings <marco.hennings@freiheit.com>
Marga Manterola <marga@google.com>
Marin Bai <marin.basic02@gmail.com>
Marius Nuennerich <mnu@google.com>
Mark Bucciarelli <mkbucc@gmail.com>
Mark Severson <miquella@gmail.com>
Mark Theunissen <mark.theunissen@gmail.com>
Mark Zavislak <zavislak@google.com>
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>
Marko Mikulicic <mkm@google.com>
Marko Tiikkaja <marko@joh.to>
Markus Duft <markus.duft@salomon.at>
Markus Sonderegger <marraison@gmail.com>
Markus Zimmermann <zimmski@gmail.com>
Martin Bertschler <mbertschler@gmail.com>
Martin Garton <garton@gmail.com>
Martin Hamrle <martin.hamrle@gmail.com>
Martin Kreichgauer <martinkr@google.com>
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>
Martin
Neubauer <m.ne@gmx.net>
Martin Olsson <martin@minimum.se>
Marvin Stenger <marvin.stenger94@gmail.com>
Mateusz Czapliski <czapkofan@gmail.com>
Mathias Beke <git@denbeke.be>
Mathias Leppich <mleppich@muhqu.de>
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>

Matt Aimonetti <mattaimonetti@gmail.com>
Matt Bostock <matt@mattbostock.com>
Matt Brown <mbrown@google.com>
Matt Drollette <matt@drollette.com>
Matt Jibson <matt.jibson@gmail.com>
Matt Joiner <anacrolix@gmail.com>
Matt Jones <mrjones@google.com>
Matt Layher <mdllyher@gmail.com>
Matt Reiferson <mreiferson@gmail.com>
Matt Robenolt <matt@ydekproductions.com>
Matt T. Proud <matt.proud@gmail.com>
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>
Matthew Brennan <matty.brennan@gmail.com>
Matthew Cottingham <mattcottingham@gmail.com>
Matthew Dempsky <mdempsky@google.com>
Matthew Denton <mdenton@skyportsystems.com>
Matthew Holt <Matthew.Holt+git@gmail.com>
Matthew Horsnell <matthew.horsnell@gmail.com>
Matthieu
Hauglustaine <matt.hauglustaine@gmail.com>
Matthieu Olivier <olivier.matthieu@gmail.com>
Max Riveiro <kavu13@gmail.com>
Maxim Khitrov <max@mxcrypt.com>
Maxim Pimenov <mpimenov@google.com>
Maxim Ushakov <ushakov@google.com>
Maxwell Krohn <themax@gmail.com>
Meir Fischer <meirfischer@gmail.com>
Meng Zhuo <mengzhuo1203@gmail.com>
Mhd Sulhan <m.shulhan@gmail.com>
Micah Stetson <micah.stetson@gmail.com>
Michael Chaten <mchaten@gmail.com>
Michael Darakananda <pongad@google.com>
Michael Elkins <michael.elkins@gmail.com>
Michael Fraenkel <michael.fraenkel@gmail.com>
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>
Michael Hoisie <hoisie@gmail.com>
Michael Hudson-Doyle <michael.hudson@linaro.org>
Michael Kufel <golang@c.michael-kaeufl.de>
Michael Kelly <mjk@google.com>
Michael Lewis <mikelikespie@gmail.com>
Michael MacInnis <Michael.P.MacInnis@gmail.com>
Michael Marineau <michael.marineau@coreos.com>
Michael Matloob <matloob@google.com>
Michael McConville
<momconville@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Michael Munday <munday@ca.ibm.com>
Michael Pearson <mipearson@gmail.com>

Michael Piatek <piatek@google.com>
Michael Pratt <mpratt@google.com>
Michael Schaller <michael@5challer.de>
Michael Shields <mshields@google.com>
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>
Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>
Michael Vetter <g.bluehut@gmail.com>
Michal Bohuslvek <mbohuslvek@gmail.com>
Michal Cierniak <cierniak@google.com>
Micha Derkacz <ziutek@inet.pl>
Michalis Kargakis <michaliskargakis@gmail.com>
Michel Lespinasse <>walken@google.com>
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>
Miguel Mendez <stxmendez@gmail.com>
Mihai Borobocea <MihaiBorobocea@gmail.com>
Mikael Tillenius <mikti42@gmail.com>
Mike Andrews <mra@xoba.com>
Mike Appleby <mike@app.leby.org>
Mike Danese <mikedanese@google.com>
Mike Houston <mike@kothar.net>
Mike
Rosset <mike.rosset@gmail.com>
Mike Samuel <mikesamuel@gmail.com>
Mike Solomon <msolo@gmail.com>
Mike Strosaker <strosake@us.ibm.com>
Mikhail Gusarov <dottedmag@dottedmag.net>
Mikhail Panchenko <m@mihasya.com>
Miki Tebeka <miki.tebeka@gmail.com>
Mikio Hara <mikioh.mikioh@gmail.com>
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>
Miquel Sabat Sol <mikisabate@gmail.com>
Miroslav Genov <mgenov@gmail.com>
Mohit Agarwal <mohit@sdf.org>
Momchil Velikov <momchil.velikov@gmail.com>
Monty Taylor <mordred@inaugust.com>
Moriyoshi Koizumi <mozo@mozo.jp>
Morten Siebuhr <sbhr@sbhr.dk>
Mshe van der Sterre <moshevds@gmail.com>
Mrunal Patel <mrunalp@gmail.com>
Muhammed Uluyol <uluyol0@gmail.com>
Nan Deng <monnand@gmail.com>
Nathan John Youngman <nj@nathany.com>
Nathan Otterness <otterness@cs.unc.edu>
Nathan P Finch <nate.finch@gmail.com>
Nathan VanBenschoten <nvanbenschoten@gmail.com>
Nathan Youngman <git@nathany.com>
Nathan(yinian) Hu <nathanhu@google.com>

Neelesh Chandola <neelesh.c98@gmail.com>
Nevins
Bartolomeo <nevins.bartolomeo@gmail.com>
Niall Sheridan <nsheridan@gmail.com>
Nic Day <nic.day@me.com>
Nicholas Katsaros <nick@nickkatsaros.com>
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>
Nicholas Sullivan <nicholas.sullivan@gmail.com>
Nicholas Waples <nwaples@gmail.com>
Nick Cooper <nmvc@google.com>
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>
Nick Harper <nharper@google.com>
Nick Leli <nicholasleli@gmail.com>
Nick Patavalis <nick.patavalis@gmail.com>
Nick Petroni <npetroni@cs.umd.edu>
Nicolas Kaiser <nikai@nikai.net>
Nicolas Owens <mischief@offblast.org>
Nicolas S. Dade <nic.dade@gmail.com>
Niels Widger <niels.widger@gmail.com>
Nigel Kerr <nigel.kerr@gmail.com>
Nigel Tao <nigeltao@golang.org>
Nik Nyby <nnyby@columbia.edu>
Niko Dziemba <niko@dziemba.com>
Nikolay Turpitko <nikolay@turpitko.com>
Noah Campbell <noahcampbell@gmail.com>
Nodir Turakulov <nodir@google.com>
Norberto Lopes <nlopes.ml@gmail.com>
Odin Ugedal <odin@ugedal.com>
Oleg
Vakheta <helginet@gmail.com>
Oleku Konko <oleku.konko@gmail.com>
Oling Cat <olingcat@gmail.com>
Oliver Hookins <ohookins@gmail.com>
Olivier Antoine <olivier.antoine@gmail.com>
Olivier Duperray <duperray.olivier@gmail.com>
Olivier Poitrey <rs@dailymotion.com>
Olivier Saingre <osaingre@gmail.com>
Omar Jarjur <ojarjur@google.com>
zgr Kesim <oec-go@kesim.org>
Padraig Kitterick <padraigkitterick@gmail.com>
Paolo Giarrusso <p.giarrusso@gmail.com>
Paolo Martini <mrtnpaolo@gmail.com>
Parker Moore <parkrmoore@gmail.com>
Pascal S. de Kloe <pascal@quies.net>
Patrick Crosby <patrick@stathat.com>
Patrick Gavlin <pgavlin@gmail.com>
Patrick Higgins <patrick.allen.higgins@gmail.com>
Patrick Lee <pattyshack101@gmail.com>

Patrick Mzard <patrick@mezard.eu>
Patrick Mylund Nielsen <patrick@patrickmn.com>
Patrick Riley <pfr@google.com>
Patrick Smith <pat42smith@gmail.com>
Paul A Querna <paul.querna@gmail.com>
Paul Borman <borman@google.com>
Paul Chang <paulchang@google.com>
Paul Hammond <paul@paulhammond.org>
Paul
Hankin <paulhankin@google.com>
Paul Lalonde <paul.a.lalonde@gmail.com>
Paul Marks <pmarks@google.com>
Paul Meyer <paul.meyer@microsoft.com>
Paul Nasrat <pnasrat@google.com>
Paul Rosania <paul.rosania@gmail.com>
Paul Sbarra <Sbarra.Paul@gmail.com>
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>
Paul van Brouwershaven <paul@vanbrouwershaven.com>
Paul Wankadia <junyer@google.com>
Paulo Casaretto <pcasaretto@gmail.com>
Pavel Paulau <pavel.paulau@gmail.com>
Pavel Zinovkin <pavel.zinovkin@gmail.com>
Pawel Knap <pawelknap88@gmail.com>
Pawel Szczur <filemon@google.com>
Percy Wegmann <ox.to.a.cart@gmail.com>
Perry Abbott <perry.j.abbott@gmail.com>
Petar Maymoukov <petarm@gmail.com>
Peter Armitage <peter.armitage@gmail.com>
Peter Collingbourne <pcc@google.com>
Peter Froehlich <peter.hans.froehlich@gmail.com>
Peter Gonda <pgonda@google.com>
Peter Kleiweg <pkleiweg@xs4all.nl>
Peter McKenzie <petermck@google.com>
Peter Moody <pmoody@uber.com>
Peter Mundy <go.peter.90@gmail.com>
Pter
Surnyi <speter.gol@gmail.com>
Pter Szab <pts@google.com>
Pter Szilgyi <peterke@gmail.com>
Peter Tseng <ptseng@squareup.com>
Peter Waldschmidt <peter@waldschmidt.com>
Peter Waller <peter.waller@gmail.com>
Peter Weinberger <pjw@golang.org>
Peter Williams <pwil3058@gmail.com>
Phil Pennock <pdp@golang.org>
Philip Brgesen <philip.brgesen@gmail.com>
Philip Hofer <phofer@umich.edu>
Philip K. Warren <pkwarren@gmail.com>

Pierre Durand <pierredurand@gmail.com>
Pierre Roullon <pierre.roullon@gmail.com>
Pieter Droogendijk <pieter@binky.org.uk>
Pietro Gagliardi <pietro10@mac.com>
Prasanna Swaminathan <prasanna@mediamath.com>
Prashant Varanasi <prashant@prashantv.com>
Preetam Jinka <pj@preet.am>
Quan Tran <qeed.quan@gmail.com>
Quan Yong Zhai <qyzhai@gmail.com>
Quentin Perez <qperez@ocs.online.net>
Quentin Smith <quentin@golang.org>
Quinn Slack <sqs@sourcegraph.com>
Quoc-Viet Nguyen <afelion@gmail.com>
Radu Berinde <radu@cockroachlabs.com>
Rafal Jeczalik <rjeczalik@gmail.com>
Rahul Chaudhry <rahulchaudhry@chromium.org>
Raif
S. Naffah <go@naffah-raif.name>
Rajat Goel <rajat.goel2010@gmail.com>
Ralph Corderoy <ralph@inputplus.co.uk>
Ramesh Dharan <dharan@google.com>
Raph Levien <raph@google.com>
Raphael Geronimi <raphael.geronimi@gmail.com>
Raul Silvera <rsilvera@google.com>
Rebecca Stambler <rstambler@golang.org>
Reinaldo de Souza Jr <juniorz@gmail.com>
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>
Rhys Hiltner <rhys@justin.tv>
Ricardo Padilha <ricardospadilha@gmail.com>
Richard Barnes <rlb@ipv.sx>
Richard Crowley <r@rcrowley.org>
Richard Eric Gavaletz <gavaletz@gmail.com>
Richard Gibson <richard.gibson@gmail.com>
Richard Miller <miller.research@gmail.com>
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>
Rick Arnold <rickarnoldjr@gmail.com>
Rick Hudson <rlh@golang.org>
Riku Voipio <riku.voipio@linaro.org>
Risto Jaakko Saarelm <rsaarelm@gmail.com>
Rob Earhart <earhart@google.com>
Rob Norman <rob.norman@infinitycloud.com>
Rob Pike <r@golang.org>
Robert
Daniel Kortschak <dan.kortschak@adelaide.edu.au>
Robert Dinu <r@varp.se>
Robert Figueiredo <robfig@gmail.com>
Robert Griesemer <gri@golang.org>
Robert Hencke <robert.hencke@gmail.com>

Robert Iannucci <iannucci@google.com>
Robert Obryk <robryk@gmail.com>
Robert Seseek <rseseek@google.com>
Robert Snedegar <roberts@google.com>
Robert Stepanek <robert.stepanek@gmail.com>
Robin Eklind <r.eklind.87@gmail.com>
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>
Roger Pau Monn <royger@gmail.com>
Roger Peppe <rogpeppe@gmail.com>
Roland Shoemaker <rolandshoemaker@gmail.com>
Ron Hashimoto <mail@h2so5.net>
Ron Minnich <rminnich@gmail.com>
Ross Light <light@google.com> <rlight2@gmail.com>
Rowan Worth <sqweek@gmail.com>
Rui Ueyama <rui@google.com>
Russ Cox <rsc@golang.org>
Russell Haering <russellhaering@gmail.com>
Ryan Bagwell <ryanbagwell@outlook.com>
Ryan Barrett <ryanb@google.com>
Ryan Brown <ribrd@b@google.com>
Ryan Hitchman
<hitchmanr@gmail.com>
Ryan Lower <rpjlower@gmail.com>
Ryan Seys <ryan@ryanseys.com>
Ryan Slade <ryanslade@gmail.com>
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>
S.alar Onur <caglar@10ur.org>
Sai Cheemalapati <saicheems@google.com>
Salmon Aljammz <s@0x65.net>
Sam Ding <samding@ca.ibm.com>
Sam Hug <samuel.b.hug@gmail.com>
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>
Sam Whited <sam@samwhited.com>
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>
Sami Commerot <samic@google.com>
Samuel Tan <samueltan@google.com>
Samuele Pedroni <pedronis@lucediaruna.net>
Sanjay Menakuru <balasanjay@gmail.com>
Sarah Adams <shadams@google.com>
Sasha Lionheart <lionhearts@google.com>
Sasha Sobol <sasha@scaledinference.com>
Scott Barron <scott.barron@github.com>
Scott Bell <scott@sctsm.com>
Scott Ferguson <scottwferg@gmail.com>
Scott Lawrence <bytbody@gmail.com>
Scott Mansfield <smansfield@netflix.com>
Scott Schwartz <scotts@golang.org>

Scott Van Woudenberg <scottvw@google.com>
Sean Burford <sburford@google.com>
Sean
Dolphin <Sean.Dolphin@kpcompass.com>
Sean Harger <sharger@google.com>
Sean Rees <sean@erifax.org>
Sebastien Binet <seb.binet@gmail.com>
Sbastien Paolacci <sebastien.paolacci@gmail.com>
Sergei Skorobogatov <skorobo@rambler.ru>
Sergey 'Snake' Gromov <snake.scaly@gmail.com>
Sergey Arseev <sergey.arseev@intel.com>
Sergio Luis O. B. Correia <sergio@correia.cc>
Seth Hoenig <seth.a.hoenig@gmail.com>
Seth Vargo <sethvargo@gmail.com>
Shahar Kohanim <skohanim@gmail.com>
Shane Hansen <shanemhansen@gmail.com>
Shaozhen Ding <dsz0111@gmail.com>
Shawn Ledbetter <sledbetter@google.com>
Shawn Smith <shawn.p.smith@gmail.com>
Shawn Walker-Salas <shawn.walker@oracle.com>
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>
Shinji Tanaka <shinji.tanaka@gmail.com>
Shivakumar GN <shivakumar.gn@gmail.com>
Shun Fan <sfan@google.com>
Silvan Jegen <s.jegen@gmail.com>
Simon Jefford <simon.jefford@gmail.com>
Simon Rawet <simon@rawet.se>
Simon Thulbourn <simon+github@thulbourn.com>
Simon Whitehead
<chemnova@gmail.com>
Sina Siadat <siadat@gmail.com>
Sokolov Yura <funny.falcon@gmail.com>
Song Gao <song@gao.io>
Spencer Nelson <s@spenczar.com>
Spring Mc <heresy.mc@gmail.com>
Srdjan Petrovic <spetrovic@google.com>
Sridhar Venkatakrishnan <sridhar@laddoo.net>
StalkR <stalkr@stalkr.net>
Stan Schwertly <stan@schwertly.com>
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>
Stphane Travostino <stephane.travostino@gmail.com>
Stephen Ma <stephenm@golang.org>
Stephen McQuay <stephen@mcquay.me>
Stephen Weinberg <stephen@q5comm.com>
Steve Francia <spf@golang.org>
Steve McCoy <mccoyst@gmail.com>
Steve Newman <snewman@google.com>
Steve Phillips <elimistev@gmail.com>

Steve Streeting <steve@stevestreeting.com>
Steven Elliot Harris <seharris@gmail.com>
Steven Hartland <steven.hartland@multiplay.co.uk>
Sugu Sougoumarane <ssougou@gmail.com>
Suharsh Sivakumar <suharshs@google.com>
Suyash <dextrous93@gmail.com>
Sven Almgren <sven@tras.se>
Sven Blumenstein <svbl@google.com>
Syohei
YOSHIDA <syohex@gmail.com>
Szabolcs Nagy <nsz@port70.net>
Tad Glines <tad.glines@gmail.com>
Taj Khattrra <taj.khattrra@gmail.com>
Takashi Matsuo <tmatsuo@google.com>
Takeshi YAMANASHI <9.nashi@gmail.com>
Takuya Ueda <uedatakuya@gmail.com>
Tal Shprecher <tshprecher@gmail.com>
Tamir Duberstein <tamird@gmail.com>
Tarmigan Casebolt <tarmigan@gmail.com>
Taru Karttunen <taruti@taruti.net>
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>
Terrel Shumway <gopher@shumway.us>
Tetsuo Kiso <tetsuokiso9@gmail.com>
Than McIntosh <thanm@google.com>
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>
Thomas Alan Copeland <talan.copeland@gmail.com>
Thomas de Zeeuw <thomasdezeeuw@gmail.com>
Thomas Desrosiers <thomasdesr@gmail.com>
Thomas Habets <habets@google.com>
Thomas Kappler <tkappler@gmail.com>
Thorben Krueger <thorben.krueger@gmail.com>
Thordur Bjornsson <thorduri@secnorth.net>
Tilman Dilo <tilman.dilo@gmail.com>
Tim Cooijmans <timcooijmans@gmail.com>
Tim Ebringer <tim.ebringer@gmail.com>
Tim
Henderson <tim.tadh@gmail.com>
Tim Hockin <thockin@google.com>
Tim Swast <swast@google.com>
Timo Savola <timo.savola@gmail.com>
Timo Truyts <alkaloid.btx@gmail.com>
Timothy Studd <tim@timstudd.com>
Tipp Moseley <tipp@google.com>
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>
Toby Burrell <kurin@google.com>
Todd Neal <todd@tneal.org>
Todd Wang <toddwang@gmail.com>
Tom Bergan <tombergan@google.com>

Tom Heng <zhm20070928@gmail.com>
Tom Linfoord <tomlinfoord@gmail.com>
Tom Szymanski <tgs@google.com>
Tom Wilkie <tom@weave.works>
Tommy Schaefer <tommy.schaefer@teecom.com>
Tor Andersson <tor.andersson@gmail.com>
Tormod Erevik Lea <tormodlea@gmail.com>
Totoro W <tw19881113@gmail.com>
Travis Cline <travis.cline@gmail.com>
Trevor Strohman <trevor.strohman@gmail.com>
Trey Lawrence <lawrence.trey@gmail.com>
Trey Tacon <ttacon@gmail.com>
Tristan Amini <tamini01@ca.ibm.com>
Tristan Colgate <tcolgate@gmail.com>
Tristan Ooohry <ooohry@gmail.com>
Tudor Golubenco
<tudor.g@gmail.com>
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>
Tyler Bunnell <tylerbunnell@gmail.com>
Tyler Treat <ttreat31@gmail.com>
Tzu-Jung Lee <roylee17@currant.com>
Ugorji Nwoke <ugorji@gmail.com>
Ulf Holm Nielsen <doktor@dyregod.dk>
Ulrich Kunitz <uli.kunitz@gmail.com>
Uriel Mangado <uriel@berlinblue.org>
Uttam C Pawar <uttam.c.pawar@intel.com>
Vadim Grek <vadimprog@gmail.com>
Vadim Vygonets <unixdj@gmail.com>
Vega Garcia Luis Alfonso <vegacom@gmail.com>
Victor Chudnovsky <vchudnov@google.com>
Vincent Ambo <tazjin@googlemail.com>
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>
Vincent Vanackere <vincent.vanackere@gmail.com>
Vinu Rajashekhar <vinutheraj@gmail.com>
Vish Subramanian <vish@google.com>
Vishvananda Ishaya <vishvananda@gmail.com>
Vitor De Mario <vitordemario@gmail.com>
Vlad Krasnov <vlad@cloudflare.com>
Vladimir Mihailenco <vladimir.webdev@gmail.com>
Vladimir Nikishenko <vova616@gmail.com>
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>
Volker
Dobler <dr.volker.dobler@gmail.com>
Volodymyr Paprotski <vpaprots@ca.ibm.com>
Walter Poupore <wpoupore@google.com>
Wedson Almeida Filho <wedsonaf@google.com>
Wei Guangjing <vcc.163@gmail.com>
Will Chan <willchan@google.com>

Will Norris <willnorris@google.com>
Willem van der Schyff <willemvds@gmail.com>
William Chan <willchan@chromium.org>
William Josephson <wjosephson@gmail.com>
William Orr <will@worrbase.com> <ay1244@gmail.com>
Wisdom Omuya <deafgoat@gmail.com>
Xia Bin <snyh@snyh.org>
Xing Xing <mikespook@gmail.com>
Xudong Zhang <felixmelon@gmail.com>
Xuyang Kang <xuyangkang@gmail.com>
Yan Zou <yzou@google.com>
Yann Kerherv <yann.kerherve@gmail.com>
Yao Zhang <lunaria21@gmail.com>
Yasuharu Goto <matope.ono@gmail.com>
Yasuhiro Matsumoto <mattn.jp@gmail.com>
Yesudeep Mangalapilly <yesudeep@google.com>
Yissakhar Z. Beck <yissakhar.beck@gmail.com>
Yo-An Lin <yoanlin93@gmail.com>
Yongjian Xu <i3dmaster@gmail.com>
Yorman Arias <cixtords@gmail.com>
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>
Yu
Heng Zhang <annita.zhang@cn.ibm.com>
Yu Xuan Zhang <zyxsh@cn.ibm.com>
Yuki Yugui Sonoda <yugui@google.com>
Yusuke Kagiwada <block.rxckin.beats@gmail.com>
Yuusei Kuwana <kuwana@kumama.org>
Yuval Pavel Zholkover <paulzhol@gmail.com>
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>
Zac Bergquist <zbergquist99@gmail.com>
Zev Goldstein <zev.goldstein@gmail.com>
Zhongwei Yao <zhongwei.yao@arm.com>
Ziad Hatahet <hatahet@gmail.com>
Zorion Arrizabalaga <zorionk@gmail.com>
<faxriddinjon@gmail.com>
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```
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Aaron Cannon <cannona@fireantproductions.com>
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Abdullah Al Maruf <mymail.maruf@gmail.com>
Abe Haskins <abeisgreat@abeisgreat.com>
```

Abhinav Gupta <abhinav.g90@gmail.com>
Adam Azarchs <adam.azarchs@10xgenomics.com>
Adam Bender <abender@google.com>
Adam Eijdenberg <adam@continusec.com>
Adam Harvey <aharvey@php.net>
Adam Kisala <adam.kisala@gmail.com>
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Adam Sindelar <adamsh@google.com>
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Adarsh Ravichandran <adarshravichandran91@gmail.com>
Aditya Mukerjee
<dev@chimeracoder.net>
Adrian Hesketh <adrianhesketh@hushmail.com>
Adrian Nos <nos.adrian@gmail.com>
Adrian O'Grady <elpollouk@gmail.com>
Adrien Bustany <adrien-xx-google@bustany.org>
Adrien Petel <peteladrien@gmail.com>
Acio Jnior <aeciodantasjunior@gmail.com>
Aeneas Rekkas (arekkas) <aeneas@ory.am>
Afanasev Stanislav <phpprogger@gmail.com>
Agis Anastasopoulos <agis.anast@gmail.com>
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Strasheim <fullung@gmail.com>
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Aleksa Sarai <cyphar@cyphar.com>
Aleksandar Dezelin <dezelin@gmail.com>
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Alexander Pantyukhin <apantykhin@gmail.com>
Alexander Polcyn <apolcyn@google.com>
Alexander Rakoczy <alex@golang.org>
Alexander Reece <awreece@gmail.com>
Alexander Surma <surma@surmair.de>
Alexander Zhavnerchik <alex.vizor@gmail.com>
Alexander Zillion <alex@alexzillion.com>
Alexander Zolotov <goldifit@gmail.com>
Alexandre Cesaro <alexandre.cesaro@gmail.com>
Alexandre Fiori <fiorix@gmail.com>
Alexandre Maari <draeron@gmail.com>
Alexandre
Normand <alexandre.normand@gmail.com>
Alexandre Parentea <aubonbeurre@gmail.com>
Alexandre Viau <alexandre@alexandreviau.net>

Alexandru Mooi <brtznr@gmail.com>
Alexei Sholik <alcosholik@gmail.com>
Alexey Alexandrov <aalexand@google.com>
Alexey Borzenkov <snaury@gmail.com>
Alexey Naidonov <alexey.naidyonov@gmail.com>
Alexey Neganov <neganovalexey@gmail.com>
Alexey Palazhchenko <alexey.palazhchenko@gmail.com>
Alexis Hildebrandt <surryhill@gmail.com>
Alexis Hunt <lexer@google.com>
Alexis Imperial-Legrand <ail@google.com>
Ali Rizvi-Santiago <arizvisa@gmail.com>
Aliaksandr Valialkin <valyala@gmail.com>
Alif Rachmawadi <subosito@gmail.com>
Allan Simon <allan.simon@supinfo.com>
Allen Li <ayatane@google.com>
Alok Menghrajani <alok.menghrajani@gmail.com>
Aman Gupta <aman@tmm1.net>
Amir Mohammad Saied <amir@gluegadget.com>
Amr Mohammed <merodiro@gmail.com>
Amrut Joshi <amrut.joshi@gmail.com>
Anand K. Mistry <anand@mistry.ninja>
Anders Pearson <anders@columbia.edu>
Anderson Queiroz <contato@andersonq.eti.br>
Andr
Carvalho <asantostc@gmail.com>
Andre Nathan <andrenth@gmail.com>
Andrea Nodari <andrea.nodari91@gmail.com>
Andrea Spadaccini <spadaccio@google.com>
Andreas Auernhammer <aead@mail.de>
Andreas Jellinghaus <andreas@ionisiert.de> <anj@google.com>
Andreas Litt <andreas.litt@gmail.com>
Andrei Gherzan <andrei@resin.io>
Andrei Korzhevskii <a.korzhevskiy@gmail.com>
Andrei Matei <andrei@cockroachlabs.com>
Andrei Tudor Clin <mail@acln.ro>
Andrei Vagin <avagin@google.com>
Andrei Vieru <euvieru@gmail.com>
Andres Erbsen <andreser@google.com>
Andres Lowrie <andres.lowrie@gmail.com>
Andrew Austin <andrewacht@gmail.com>
Andrew Balholm <andybalholm@gmail.com>
Andrew Benton <andrewmbenton@gmail.com>
Andrew Bonventre <andybons@chromium.org>
Andrew Braunstein <awbraunstein@gmail.com>
Andrew Bursavich <abursavich@gmail.com>
Andrew Ekstedt <andrew.ekstedt@gmail.com>
Andrew Etter <andrew.etter@gmail.com>
Andrew Gerrand <adg@golang.org>

Andrew Harding <andrew@spacemonkey.com>
Andrew Jackura
<ajackura@google.com>
Andrew Lutomirski <andy@luto.us>
Andrew Pilloud <andrewpilloud@igneoussystems.com>
Andrew Pogrebnoy <absourd.noise@gmail.com>
Andrew Poydence <apoydence@pivotal.io>
Andrew Pritchard <awpritchard@gmail.com>
Andrew Radev <andrey.radev@gmail.com>
Andrew Skiba <skibaa@gmail.com>
Andrew Stribblehill <ads@wompom.org>
Andrew Szeto <andrew@jabagawee.com>
Andrew Todd <andrew.todd@wework.com>
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>
Andrew Wilkins <axwalk@gmail.com>
Andrew Williams <williams.andrew@gmail.com>
Andrew Z Allen <me@andrewzallen.com>
Andrey Mirtchovski <mirtchovski@gmail.com>
Andrey Petrov <andrey.petrov@shazow.net>
Andrii Soldatenko <andrii.soldatenko@gmail.com>
Andrii Soluk <isoluchok@gmail.com>
Andriy Lytvynov <lytvynov.a.v@gmail.com>
Andrzej eel <andrii.zhezhel@gmail.com>
Andy Balholm <andy@balholm.com>
Andy Davis <andy@bigandian.com>
Andy Finkenstadt <afinkenstadt@zynga.com>
Andy Lindeman <andy@lindeman.io>
Andy Maloney <asmaloney@gmail.com>
Andy
Walker <walkeraj@gmail.com>
Andzej Maciusovic <andzej.maciusovic@gmail.com>
Anfernee Yongkun Gui <anfernee.gui@gmail.com>
Angelo Bulfone <mbulfone@gmail.com>
Anh Hai Trinh <anh.hai.trinh@gmail.com>
Anit Gandhi <anitgandhi@gmail.com>
Ankit Goyal <ankit3goyal@gmail.com>
Anmol Sethi <anmol@aubble.com>
Anschel Schaffer-Cohen <anschelsc@gmail.com>
Anthony Alves <cvballa3g0@gmail.com>
Anthony Canino <anthony.canino1@gmail.com>
Anthony Eufemio <anthony.eufemio@gmail.com>
Anthony Fok <foka@debian.org>
Anthony Martin <alidity@pbrane.org>
Anthony Sottile <asottile@umich.edu>
Anthony Starks <ajstarks@gmail.com>
Anthony Voutas <voutasaurus@gmail.com>
Anthony Woods <awoods@raintank.io>
Antoine GIRARD <sapk@sapk.fr>

Antoine Martin <antoine97.martin@gmail.com>
Anton Gyllenberg <anton@iki.fi>
Antonin Amand <antonin.amand@gmail.com>
Antonio Antelo <aantelov87@gmail.com>
Antonio Bibiano <antbbn@gmail.com>
Antonio Murdaca <runcom@redhat.com>
Antonio Troina <thoeni@gmail.com>
Aofei Sheng <aofei@aofeisheng.com>
Apisak
Darakananda <pongad@gmail.com>
Aram Hvrneanu <aram@mgk.ro>
Arash Bina <arash@arash.io>
Areski Belaid <areski@gmail.com>
Ariel Mashraki <ariel@mashraki.co.il>
Arkadi Pyuro <arkadi@google.com>
Arlo Breault <arlolra@gmail.com>
Arnaud Ysmal <arnaud.ysmal@gmail.com>
Arne Hormann <arnehormann@gmail.com>
Arnout Engelen <arnout@bzst.net>
Aron Nopanen <aron.nopanen@gmail.com>
Artem Kolin <artemkaxboy@gmail.com>
Arthur Fabre <arthur@arthurfabre.com>
Arthur Khashaev <arthur@khashaev.ru>
Artyom Pervukhin <artyom.pervukhin@gmail.com>
Arvindh Rajesh Tamilmani <art@a-30.net>
Ashish Gandhi <ag@ashishgandhi.org>
Asim Shankar <asimshankar@gmail.com>
Atin Malaviya <amalaviy@akamai.com>
Ato Araki <ato.araki@gmail.com>
Audrey Lim <audreylh@gmail.com>
Audrius Butkevicius <audrius.butkevicius@gmail.com>
Augusto Roman <aroman@gmail.com>
Aulus Egnatius Varialus <varialus@gmail.com>
Aurlien Rainone <aurelien.rainone@gmail.com>
Austin Clements <austin@google.com> <aclements@csail.mit.edu>
Avi
Flax <avi@timehop.com>
awaw fumin <awawfumin@gmail.com>
Awn Umar <awn@cryptolosophy.io>
Axel Wagner <axel.wagner.hh@googlemail.com>
Ayanamist Yang <ayanamist@gmail.com>
Aymerick Jhanne <aymerick@jehanne.org>
Azat Kaumov <kaumov.a.r@gmail.com>
Baiju Muthukadan <baiju.m.mail@gmail.com>
Balaram Makam <bmakam.qdt@qualcommdatacenter.com>
Balazs Lecz <leczb@google.com>
Baokun Lee <nototon@gmail.com>
Bartosz Grzybowski <melkorm@gmail.com>

Bartosz Oler <brtsz@google.com>
Bastian Ike <bastian.ike@gmail.com>
Ben Burkert <ben@benburkert.com>
Ben Eitzen <eitzenb@golang.org>
Ben Fried <ben.fried@gmail.com>
Ben Haines <bhainesva@gmail.com>
Ben Hoyt <benhoyt@gmail.com>
Ben Laurie <ben@links.org> <benl@google.com>
Ben Lubar <ben.lubar@gmail.com>
Ben Lynn <benlynn@gmail.com>
Ben Olive <sionide21@gmail.com>
Ben Schwartz <bemasc@google.com>
Ben Shi <powerman1st@163.com>
Benjamin Black <b@b3k.us>
Benjamin Cable <cable.benjamin@gmail.com>
Benjamin Hsieh <tanookiben@users.noreply.github.com>
Benjamin Peterson
<benjamin@python.org>
Benjamin Prosnitz <bprosnitz@google.com>
Benjamin Wester <bwester@squareup.com>
Benny Siegert <bsiegert@gmail.com>
Benoit Sigoure <tsunanet@gmail.com>
Berengar Lehr <Berengar.Lehr@gmx.de>
Berkant Ipek <41230766+0xbkt@users.noreply.github.com>
Bharath Thiruveedula <tbharath91@gmail.com>
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>
Bill O'Farrell <billo@ca.ibm.com>
Bill Prin <waprin@google.com>
Bill Thiede <couchmoney@gmail.com>
Bill Zissimopoulos <billziss@navimatics.com>
Billie Harold Cleek <bhcleek@gmail.com>
Billy Lynch <wlynch@google.com>
Bjrn Erik Pedersen <bjorn.erik.pedersen@gmail.com>
Bjorn Tillenius <bjorn@tillenius.me>
Bjorn Tipling <bjorn.tipling@gmail.com>
Blain Smith <rebelgeek@blainsmith.com>
Blake Gentry <blakesgentry@gmail.com>
Blake Mesdag <blakemesdag@gmail.com>
Blake Mizerany <blake.mizerany@gmail.com>
Blixt <me@blixt.nyc>
Bob Briski <rbriski@gmail.com>
Bob Potter <bobby.potter@gmail.com>
Bobby DeSimone <bobbydesimone@gmail.com>
Bobby
Powers <bobbypowers@gmail.com>
Boris Nagaev <nagaev@google.com>
Borja Clemente <borja.clemente@gmail.com>
Brad Burch <brad.burch@gmail.com>

Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>
Brad Garcia <bgarcia@golang.org>
Brad Jones <rbjones@google.com>
Brad Morgan <brad@morgabra.com>
Brad Whitaker <bwhitaker@fastly.com>
Braden Bassingthwaite <bbassingthwaite@vendasta.com>
Bradley Falzon <brad@teambrod.net>
Brady Catherman <brady@gmail.com>
Brady Sullivan <brady@bsull.com>
Brandon Bennett <bbennett@fb.com>
Brandon Gilmore <varz@google.com>
Brandon Ryan <bjryan19@gmail.com>
Brendan Daniel Tracey <tracey.brendan@gmail.com>
Brendan O'Dea <bod@golang.org>
Brett Cannon <bcannon@gmail.com>
Brett Merrill <brett.j.merrill94@gmail.com>
Brian Dellisanti <briandellisanti@gmail.com>
Brian Downs <brian.downs@gmail.com>
Brian G. Merrell <bgmerrell@gmail.com>
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com> <bgm@google.com>
Brian Kennedy <btkennedy@gmail.com>
Brian
Kessler <brian.m.kessler@gmail.com>
Brian Ketelsen <bketelsen@gmail.com>
Brian Slesinsky <skybrian@google.com>
Brian Smith <ohohvi@gmail.com>
Brian Starke <brian.starke@gmail.com>
Bryan Alexander <Kozical@msn.com>
Bryan C. Mills <bcmills@google.com>
Bryan Chan <bryan.chan@ca.ibm.com>
Bryan Ford <brynosaurus@gmail.com>
Bryan Heden <b.heden@gmail.com>
Bulat Gaifullin <gaifullinbf@gmail.com>
Burak Guven <bguven@gmail.com>
Caine Tighe <arctanofyourface@gmail.com>
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>
Caleb Martinez <accounts@calebmartinez.com>
Caleb Spare <cespare@gmail.com>
Carl Chatfield <carlchatfield@gmail.com>
Carl Henrik Lunde <chlunde@ifi.uio.no>
Carl Jackson <carl@stripe.com>
Carl Johnson <me@carlmjohnson.net>
Carl Mastrangelo <notcarl@google.com>
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>
Carlisia Campos <carlisia@grokkingtech.io>
Carlo Alberto Ferraris <cafxx@strayorange.com>
Carlos Castillo <cookieo9@gmail.com>
Carlos Cirello <uldericofilho@gmail.com>

Carlos
Eduardo <me@carlosedp.com>
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>
Carlos Souza <carloshrsouza@gmail.com>
Carolyn Van Slyck <me@carolynvanslyck.com>
Carrie Bynon <cbyn@gmail.com>
Cary Hull <chull@google.com>
Case Nelson <case.nelson@gmail.com>
Casey Callendrello <squeed@gmail.com>
Casey Marshall <casey.marshall@gmail.com>
Catalin Nicutar <cnicutar@google.com>
Catalin Patulea <catalinp@google.com>
Cedric Staub <cs@squareup.com>
Cezar S Espinola <cezarsa@gmail.com>
Chad Rosier <mrosier.qdt@qualcommdatacenter.com>
ChaiShushan <chaishushan@gmail.com>
Channing Kimble-Brown <channing@golang.org>
Charles Fenwick Elliott <Charles@FenwickElliott.io>
Charles Kenney <charlesc.kenney@gmail.com>
Charles L. Dorian <cldorian@gmail.com>
Charles Lee <zombie.fml@gmail.com>
Charles Weill <weill@google.com>
Cherry Zhang <cherryyz@google.com>
Chew Choon Keat <choonkeat@gmail.com>
Cholerae Hu <choleraehyq@gmail.com>
Chotepud Teo <AlexRouSg@users.noreply.github.com>
Chris Ball
<chris@printf.net>
Chris Biscardi <chris@christopherbiscardi.com>
Chris Broadfoot <cbro@golang.org>
Chris Dollin <ehog.hedge@gmail.com>
Chris Farmiloe <chrisfarms@gmail.com>
Chris Hines <chris.cs.guy@gmail.com>
Chris Howey <howeyc@gmail.com>
Chris Hundt <hundt@google.com>
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>
Chris Kastorff <encryptio@gmail.com>
Chris Lennert <calennert@gmail.com>
Chris Liles <caveryliles@gmail.com>
Chris Manghane <cmang@golang.org>
Chris Marchesi <chrism@vanclueverttech.com>
Chris McGee <sirnewton_01@yahoo.ca> <newton688@gmail.com>
Chris Raynor <raynor@google.com>
Chris Roche <rodaine@gmail.com>
Chris Smith <chrsmith@users.noreply.github.com>
Chris Stockton <chrisstocktonaz@gmail.com>
Chris Zou <chriszou@ca.ibm.com>
Christian Alexander <christian@linux.com>

Christian Couder <chriscool@tuxfamily.org>
Christian Himpel <chressie@googlemail.com> <chressie@gmail.com>
Christian Muehlhaeuser <muesli@gmail.com>
Christian Pellegrin <chri@evolware.org>
Christian
R. Petrin <christianpetrin@gmail.com>
Christine Hansmann <chhansmann@gmail.com>
Christoffer Buchholz <christoffer.buchholz@gmail.com>
Christoph Blecker <admin@toph.ca>
Christoph Hack <christoph@tux21b.org>
Christopher Cahoon <chris.cahoon@gmail.com>
Christopher Guiney <chris@guiney.net>
Christopher Henderson <chris@chenderson.org>
Christopher Koch <chrisko@google.com>
Christopher Nelson <nadiasvertex@gmail.com>
Christopher Nielsen <m4dh4tt3r@gmail.com>
Christopher Redden <christopher.redden@gmail.com>
Christopher Swenson <cswenson@google.com>
Christopher Wedgwood <cw@f00f.org>
Christos Zoulas <christos@zoulas.com> <zoulasc@gmail.com>
Christy Perez <christy@linux.vnet.ibm.com>
CL Sung <clsung@gmail.com> <cl_sung@htc.com>
Clement Chigot <clement.chigot@atos.net>
Clement Skau <clementskau@gmail.com>
Cody Oss <the.cody.oss@gmail.com>
Colby Ranger <cranger@google.com>
Colin Arnott <colin@urandom.co.uk>
Colin Cross <ccross@android.com>
Colin Edwards <colin@recursivepenguin.com>
Colin
Kennedy <moshen.colin@gmail.com>
Colin Nelson <colnnelson@google.com>
Colin Rice <clr@google.com>
Conrad Irwin <conrad.irwin@gmail.com>
Conrad Meyer <cemeyer@cs.washington.edu>
Conrado Gouvea <conradopl@gmail.com>
Constantin Konstantinidis <constantinkonstantinidis@gmail.com>
Corey Thomasson <cthom.lists@gmail.com>
Cosmos Nicolaou <cnicolaou@google.com>
Costin Chirvasuta <ctin@google.com>
Craig Citro <craigcitro@google.com>
Cristian Staretu <unclejacksons@gmail.com>
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>
Cyrill Schumacher <cyrill@schumacher.fm>
Daisuke Fujita <dtanshi45@gmail.com>
Daker Fernandes Pinheiro <daker.fernandes.pinheiro@intel.com>
Damian Gryski <dgryski@gmail.com>
Damien Lespiau <damien.lespiau@gmail.com> <damien.lespiau@intel.com>

Damien Mathieu <42@dmathieu.com>
Damien Neil <dneil@google.com>
Damien Tournoud <damien@platform.sh>
Dan Ballard <dan@mindstab.net>
Dan Caddigan <goldcaddy77@gmail.com>
Dan Callahan <dan.callahan@gmail.com>
Dan Harrington <harringtond@google.com>
Dan
Jacques <dnj@google.com>
Dan Johnson <computerdruid@google.com>
Dan Peterson <dpiddy@gmail.com>
Dan Pupius <dan@medium.com>
Dan Sinclair <dan.sinclair@gmail.com>
Daniel Cormier <danielc@knowbe4.com>
Danil de Kok <me@danieldk.eu>
Daniel Fleischman <danielfleischman@gmail.com>
Daniel Ingram <ingramds@appstate.edu>
Daniel Johansson <dajo2002@gmail.com>
Daniel Kerwin <d.kerwin@gini.net>
Daniel Krech <eikeon@eikeon.com>
Daniel Langner <s8572327@gmail.com>
Daniel Lidn <daniel.liden.87@gmail.com>
Daniel Lublin <daniel@lublin.se>
Daniel Mart <mvdan@mvdan.cc>
Daniel Morsing <daniel.morsing@gmail.com>
Daniel Nadasi <dnadasi@google.com>
Daniel Nephin <dnephin@gmail.com>
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>
Daniel Skinner <daniel@dasa.cc>
Daniel Speichert <daniel@speichert.pl>
Daniel Theophanes <kardianos@gmail.com>
Daniel Upton <daniel@floppy.co>
Daniela Petruzalek <daniela.petruszalek@gmail.com>
Danny Rosseau <daniel.rosseau@gmail.com>
Daria Koliustratova
<daria.koliustratova@intel.com>
Darien Raymond <admin@v2ray.com>
Darren Elwood <darren@textnode.com>
Darren Grant <darren.e.grant@gmail.com>
Darren McCleary <darren.rmc@gmail.com>
Darshan Parajuli <parajulidarshan@gmail.com>
Datong Sun <dndx@idndx.com>
Dave Borowitz <dborowitz@google.com>
Dave Bort <dbort@golang.org>
Dave Cheney <dave@cheney.net>
Dave Day <djd@golang.org>
Dave Grijalva <dgrijalva@ngmoco.com>
Dave MacFarlane <driusan@gmail.com>

Dave Russell <forfuncsake@gmail.com>
David Anderson <danderson@google.com>
David Barnett <dbarnett@google.com>
David Benjamin <davidben@google.com>
David Brophy <dave@brophy.uk>
David Brgin <676c7473@gmail.com>
David Calavera <david.calavera@gmail.com>
David Carlier <devnexen@gmail.com>
David Chase <drchase@google.com>
David Covert <davidhcovert@gmail.com>
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>
David du Colombier <0intro@gmail.com>
David Finkel <david.finkel@gmail.com>
David Forsythe <dforsythe@gmail.com>
David
G. Andersen <dave.andersen@gmail.com>
David Glasser <glasser@meteor.com>
David Heuschmann <heuschmann.d@gmail.com>
David Howden <dhowden@gmail.com>
David Hubbard <dsp@google.com>
David Jakob Fritz <david.jakob.fritz@gmail.com>
David Jones <dxjones@gmail.com>
David Lazar <lazard@golang.org>
David Leon Gil <coruus@gmail.com>
David McLeish <davemc@google.com>
David Ndungu <dnjuguna@gmail.com>
David NewHamlet <david@newhamlet.com>
David Presotto <presotto@gmail.com>
David R. Jenni <david.r.jenni@gmail.com>
David Sansome <me@davidsansome.com>
David Stainton <dstainton415@gmail.com>
David Symonds <dsymonds@golang.org>
David Thomas <davidthomas426@gmail.com>
David Timm <dtimm@pivotal.io>
David Titarenco <david.titarenco@gmail.com>
David Tolpin <david.tolpin@gmail.com>
David Url <david@urld.io>
David Volquartz Lebech <david@lebech.info>
David Wimmer <davidlwimmer@gmail.com>
Davies Liu <davies.liu@gmail.com>
Davor Kapsa <davor.kapsa@gmail.com>
Dean Prichard <dean.prichard@gmail.com>
Deepak
Jois <deepak.jois@gmail.com>
Denis Bernard <db047h@gmail.com>
Denis Brandolini <denis.brandolini@gmail.com>
Denis Nagorny <denis.nagorny@intel.com>
Dennis Kuhnert <mail.kuhnert@gmail.com>

Denys Honsiorovskyi <honsiorovskyi@gmail.com>
Denys Smirnov <denis.smirnov.91@gmail.com>
Derek Buitenhuis <derek.buitenhuis@gmail.com>
Derek Che <drc@yahoo-inc.com>
Derek McGowan <derek@mcgstyle.net>
Derek Parker <parkerderek86@gmail.com>
Derek Phan <derekphan94@gmail.com>
Derek Shockey <derek.shockey@gmail.com>
Dev Ojha <dojha12@gmail.com>
Dev Zhoujun <dev.zhoujun@gmail.com>
Devon H. O'Dell <devon.odell@gmail.com>
Dhaivat Pandit <dhaivatpandit@gmail.com>
Dhananjay Nakrani <dhananjayn@google.com>
Dhiru Kholia <dhiru.kholia@gmail.com>
Dhruvdudd Jadhav <dhrvdudd.jadhav@gmail.com>
Di Xiao <dixiao@google.com>
Didier Spezia <didier.06@gmail.com>
Diego Siqueira <diego9889@gmail.com>
Dieter Plaetinck <dieter@raintank.io>
Dimitri Sokolyuk <sokolyuk@gmail.com>
Dimitri Tcaciuc <dtcaciuc@gmail.com>
Dina
Garmash <dgrmsh@gmail.com>
Diogo Pinela <diogoid7400@gmail.com>
Dirk Gadsden <dirk@esherido.com>
Diwaker Gupta <diwakergupta@gmail.com>
Dmitri Goutnik <dgoutnik@gmail.com>
Dmitri Popov <operator@cv.dp-net.com>
Dmitri Shuralyov <dmitshur@golang.org> <dmitri@shuralyov.com>
Dmitriy Cherchenko <dcherchenko@gmail.com>
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>
Dmitriy Vyukov <dvyukov@google.com>
Dmitry Chestnykh <dchest@gmail.com>
Dmitry Doroginin <doroginin@gmail.com>
Dmitry Mottl <dmitry.mottl@gmail.com>
Dmitry Neverov <dmitry.neverov@gmail.com>
Dmitry Savintsev <dsavints@gmail.com>
Dmitry Yakunin <nonamezeil@gmail.com>
Domen Ipavec <domen@ipavec.net>
Dominic Green <dominicgreen1@gmail.com>
Dominik Honnef <dominik.honnef@gmail.com>
Dominik Vogt <vogt@linux.vnet.ibm.com>
Don Byington <don@dbyington.com>
Donald Huang <don.hcd@gmail.com>
Dong-hee Na <donghee.na92@gmail.com>
Donovan Hide <donovanhide@gmail.com>
Doug Anderson <douga@google.com>

Doug

Fawley <dfawley@google.com>
Douglas Danger Manley <doug.manley@gmail.com>
Drew Flower <drewvanstone@gmail.com>
Drew Hintz <adhintz@google.com>
Duncan Holm <mail@frou.org>
Dustin Carlino <dcarlino@google.com>
Dustin Herbison <djherbis@gmail.com>
Dustin Long <dustmop@gmail.com>
Dustin Sallings <dsallings@gmail.com>
Dustin Shields-Cloues <dcloues@gmail.com>
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>
Dylan Waits <dylan@waits.io>
Edan Bedrik <3d4nb3@gmail.com>
Eddie Scholtz <escholtz@google.com>
Eden Li <eden.li@gmail.com>
Eduard Urbach <e.urbach@gmail.com>
Eduardo Ramalho <eduardo.ramalho@gmail.com>
Edward Muller <edwardam@interlix.com>
Egon Elbre <egonelbre@gmail.com>
Ehren Kret <ehren.kret@gmail.com>
Eitan Adler <lists@eitanadler.com>
Eivind Uggedal <eivind@uggedal.com>
Elbert Fliek <efliek@gmail.com>
Eldar Rakhimberdin <ibeono@gmail.com>
Elena Grahovac <elena@grahovac.me>
Eli Bendersky <eliben@google.com>
Elias Naur <mail@eliasnaur.com> <elias.naur@gmail.com>

Elliot

Morrison-Reed <elliottmr@gmail.com>
Emerson Lin <linyintor@gmail.com>
Emil Hessman <emil@hessman.se>
Emil Mursalimov <mursalimovemeel@gmail.com>
Emilien Kenler <hello@emilienkenler.com>
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>
Eno Compton <enocom@google.com>
Eoghan Sherry <ejsherry@gmail.com>
Eric Chiang <eric.chiang.m@gmail.com>
Eric Clark <zerohp@gmail.com>
Eric Daniels <eric@erdaniels.com>
Eric Engestrom <eric@engestrom.ch>
Eric Garrido <ekg@google.com>
Eric Koleda <ekoleda+devrel@google.com>
Eric Lagergren <ericscottlagergren@gmail.com>
Eric Milliken <emilliken@gmail.com>
Eric Pauley <eric@pauley.me>
Eric Ponce <tricokun@gmail.com>
Eric Rescorla <ekr@rtfm.com>

Eric Roshan-Eisner <eric.d.eisner@gmail.com>
Eric Rykwaldler <e.rykwaldler@gmail.com>
Erik Aigner <aigner.erik@gmail.com>
Erik Dubbelboer <erik@dubbelboer.com>
Erik St. Martin <alakriti@gmail.com>
Erik Staab <estaab@google.com>
Erik Westrup <erik.westrup@gmail.com>
Erin Masatsugu <erin.masatsugu@gmail.com>
Ernest
Chiang <ernest_chiang@htc.com>
Erwin Oegema <blablaechthema@hotmail.com>
Esko Luontola <esko.luontola@gmail.com>
Ethan Burns <eaburns@google.com>
Ethan Miller <eamiller@us.ibm.com>
Euan Kemp <euank@euank.com>
Eugene Kalinin <e.v.kalinin@gmail.com>
Evan Broder <evan@stripe.com>
Evan Brown <evanbrown@google.com>
Evan Digby <evandigby@gmail.com>
Evan Hicks <evan.hicks2@gmail.com>
Evan Jones <ej@evanjones.ca>
Evan Klitzke <evan@eklitzke.org>
Evan Kroske <evankroske@google.com>
Evan Martin <evan.martin@gmail.com>
Evan Phoenix <evan@phx.io>
Evan Shaw <chickencha@gmail.com>
Evgeniy Polyakov <zbr@ioremap.net>
Ewan Chou <coocood@gmail.com>
Ewan Valentine <ewan.valentine89@gmail.com>
Eyal Posener <posener@gmail.com>
Fabian Wickborn <fabian@wickborn.net>
Fabian Zarembo <fabian@youreemail.eu>
Fabrizio Milo <mistobaan@gmail.com>
Faiyaz Ahmed <ahmedf@vmware.com>
Fan Hongjian <fan.howard@gmail.com>
Fangming Fang <fangming.fang@arm.com>
Fannie Zhang <fannie.zhang@arm.com>
Fatih Arslan <fatih@arslan.io>
Fazal
Majid <majid@apsalar.com>
Fazlul Shahriar <fshahriar@gmail.com>
Federico Bond <federicobond@gmail.com>
Federico Simoncelli <fsimonce@redhat.com>
Fedor Indutny <fedor@indutny.com>
Fedor Korotkiy <dartslon@gmail.com>
Felipe Oliveira <felipeweb.programador@gmail.com>
Felix Bnemann <Felix.Buenemann@gmail.com>
Felix Geisendrfer <haimuiba@gmail.com>

Felix Kollmann <fk@konsorten.de>
Filip Gruszczyski <gruszcz@ gmail.com>
Filip Haglund <drathier@users.noreply.github.com>
Filip Stanis <fstanis@google.com>
Filippo Valsorda <filippo@golang.org> <filippo@cloudflare.com> <hi@filippo.io>
Firmansyah Adiputra <frm.adiputra@gmail.com>
Florian Forster <octo@google.com>
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>
Florian Weimer <fw@deneb.enyo.de>
Florin Patan <florinpatan@gmail.com>
Folke Behrens <folke@google.com>
Ford Hurley <ford.hurley@gmail.com>
Francesc Campoy <campoy@golang.org>
Francesco Renzi <rentziass@gmail.com>
Francisco Claude <fclaude@recoded.cl>
Francisco
Rojas <francisco.rojas.gallegos@gmail.com>
Francisco Souza <franciscossouza@gmail.com>
Frank Schroeder <frank.schroeder@gmail.com>
Frank Somers <fsomers@arista.com>
Frederic Guillot <frederic.guillot@gmail.com>
Frederick Kelly Mayle III <frederickmayle@gmail.com>
Frederik Ring <frederik.ring@gmail.com>
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>
Fredrik Forsmo <fredrik.forsmo@gmail.com>
Fredrik Wallgren <fredrik.wallgren@gmail.com>
Frew Schmidt <github@frew.co>
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>
Frits van Bommel <fvbommel@gmail.com>
Fumitoshi Ukai <ukai@google.com>
G. Hussain Chinoy <ghchinoy@gmail.com>
Gaal Yahas <gaal@google.com>
Gabrel Arthr Ptursson <gabriel@system.is>
Gabriel Aszalos <gabriel.aszalos@gmail.com>
Gabriel Guzman <gabe.guzman@gmail.com>
Gabriel Nelle <tehsphinx@web.de>
Gabriel Nicolas Avellaneda <avellaneda.gabriel@gmail.com>
Gabriel Russell <gabriel.russell@gmail.com>
Gareth Paul Jones <gpj@foursquare.com>
Garret
Kelly <gdk@google.com>
Garrick Evans <garrick@google.com>
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>
Gary Elliott <garyelliott@google.com>
Gaurish Sharma <contact@aurishsharma.com>
Gautham Thambidorai <gautham.dorai@gmail.com>
Gauthier Jolly <gauthier.jolly@gmail.com>
Geert-Johan Riemer <gjr19912@gmail.com>

Genevieve Luyt <genevieve.luyt@gmail.com>
Gengliang Wang <ltnwgl@gmail.com>
Geoff Berry <gberry.qdt@qualcommdatacenter.com>
Geoffroy Lorieux <lorieux.g@gmail.com>
Geon Kim <geon0250@gmail.com>
Georg Reinke <guelfey@gmail.com>
George Gkirtsou <ggirtsou@gmail.com>
George Shammas <george@shamm.as> <georgyo@gmail.com>
Gerasimos (Makis) Maropoulos <kataras2006@hotmail.com>
Gerasimos Dimitriadis <gedimitr@gmail.com>
Gergely Brautigam <skarlso777@gmail.com>
Gernot Vormayr <gvormayr@gmail.com>
Getulio Snchez <valentin2507@gmail.com>
Gianguido Sora` <g.sora4@gmail.com>
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>
Giles Lean <giles.lean@pobox.com>
Giovanni Bajo <rasky@develer.com>
GitHub
User @ajnrp (1688456) <ajnrp@users.noreply.github.com>
GitHub User @alkesh26 (1019076) <alkesh26@gmail.com>
GitHub User @andrius4669 (4699695) <andrius4669@gmail.com>
GitHub User @as (8127015) <as.utf8@gmail.com>
GitHub User @bakape (7851952) <bakape@gmail.com>
GitHub User @bgadrian (830001) <aditza8@gmail.com>
GitHub User @bontequero (2674999) <bontequero@gmail.com>
GitHub User @cch123 (384546) <buaa.cch@gmail.com>
GitHub User @chanxuehong (3416908) <chanxuehong@gmail.com>
GitHub User @dupoxy (1143957) <dupoxy@users.noreply.github.com>
GitHub User @erifan (31343225) <eric.fang@arm.com>
GitHub User @esell (9735165) <eujon.sellers@gmail.com>
GitHub User @frennie (6499251) <mail@rhab.de>
GitHub User @hengwu0 (41297446) <41297446+hengwu0@users.noreply.github.com>
GitHub User @itchyny (375258) <itchyny@hatena.ne.jp>
GitHub User @kazysshr (30496953) <kazysshr0301@gmail.com>
GitHub User @kc1212 (1093806) <kc1212@users.noreply.github.com>
GitHub User @Kropekk (13366453)
<kamilkropiewnicki@gmail.com>
GitHub User @linguohua (3434367) <lghchinaidea@gmail.com>
GitHub User @LotusFenn (13775899) <fenn.lotus@gmail.com>
GitHub User @madiganz (18340029) <zacharywmadigan@gmail.com>
GitHub User @micnncim (21333876) <micnncim@gmail.com>
GitHub User @mkishere (224617) <224617+mkishere@users.noreply.github.com>
GitHub User @OlgaVIPetrova (44112727) <OVPPetrova@gmail.com>
GitHub User @pityonline (438222) <pityonline@gmail.com>
GitHub User @pytimer (17105586) <lixin20101023@gmail.com>
GitHub User @saitarunreddy (21041941) <saitarunreddypalla@gmail.com>
GitHub User @shogo-ma (9860598) <Choroma194@gmail.com>
GitHub User @tatsumack (4510569) <tatsu.mack@gmail.com>

GitHub User @tell-k (26263) <ffk2005@gmail.com>
GitHub User @uhei (2116845) <uhei@users.noreply.github.com>
GitHub User @uropek (39370426) <uropek@gmail.com>
GitHub User @utkarsh-extc (53217283) <53217283+utkarsh-extc@users.noreply.github.com>
GitHub User @yuanhh (1298735) <yuan415030@gmail.com>
GitHub User
@ZZMarquis (7624583) <zhonglingjian3821@163.com>
Giulio Iotti <dullgiulio@gmail.com>
Giulio Micheloni <giulio.micheloni@gmail.com>
Giuseppe Valente <gvalente@arista.com>
Gleb Stepanov <glebstepanov1992@gmail.com>
Glenn Brown <glennb@google.com>
Glenn Lewis <gmlewis@google.com>
Gordon Klaus <gordon.klaus@gmail.com>
Gordon Tyler <gordon@doxxx.net>
Graham King <graham4king@gmail.com>
Graham Miller <graham.miller@gmail.com>
Grant Griffiths <ggp493@gmail.com>
Greg Poirier <greg.istehbest@gmail.com>
Greg Steuck <gnezdo+github@google.com>
Greg Thelen <gthelen@google.com>
Greg Ward <greg@gerg.ca>
Grgoire Delattre <gregoire.delattre@gmail.com>
Gregory Man <man.gregory@gmail.com>
Guilherme Caruso <gui.martinscaruso@gmail.com>
Guilherme Garnier <guilherme.garnier@gmail.com>
Guilherme Goncalves <guilhermeaugustosg@gmail.com>
Guilherme Rezende <guilhermebr@gmail.com>
Guillaume J. Charmes <guillaume@charmes.net>
Guobiao Mei <meiguobiao@gmail.com>
Guoliang Wang <iamwgliang@gmail.com>
Gustav Paul <gustav.paul@gmail.com>
Gustav
Westling <gustav@westling.xyz>
Gustavo Franco <gustavorfranco@gmail.com>
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>
Gwenael Treguier <gwenn.kahz@gmail.com>
Gyu-Ho Lee <gyuhox@gmail.com>
H. brahim Gngr <igungor@gmail.com>
Hajime Hoshi <hajimehoshi@gmail.com>
Hallgrimur Gunnarsson <halg@google.com>
HAMANO Tsukasa <hamano@osstech.co.jp>
Han-Wen Nienhuys <hanwen@google.com>
Hang Qian <hangqian90@gmail.com>
Hanjun Kim <hallazzang@gmail.com>
Haosdent Huang <haosdent@gmail.com>
Harald Nordgren <haraldnordgren@gmail.com>
Hari haran <hariharan.uno@gmail.com>

Hariharan Srinath <srinathh@gmail.com>
Harley Laue <losinggeneration@gmail.com>
Harry Moreno <morenoh149@gmail.com>
Harshavardhana <hrshvardhana@gmail.com>
Hasan Ozgan <hasan@ozgan.net>
Hauke Lffler <hloeffler@users.noreply.github.com>
Hvard Haugen <havard.haugen@gmail.com>
He Liu <liulonnie@gmail.com>
Hector Chu <hectorchu@gmail.com>
Hector Martin Cantero <hector@marcansoft.com>
Henning Schmiedehausen
<henning@schmiedehausen.org>
Henrik Edwards <henrik.edwards@gmail.com>
Henrik Hodne <henrik@hodne.io>
Henry Adi Sumarto <henry.adisumarto@gmail.com>
Henry Bubert <google@mindeco.de>
Henry Chang <mr.changyuheng@gmail.com>
Henry Clifford <h.a.clifford@gmail.com>
Henry Wong <liushuai.wang@elastic.co>
Herbert Georg Fischer <herbert.fischer@gmail.com>
Herbie Ong <herbie@google.com>
Heschi Kreinick <heschi@google.com>
Hidetatsu Yaginuma <ygnmhdt@gmail.com>
Hilko Bengen <bengen@hilluzination.de>
Hiroaki Nakamura <hnakamur@gmail.com>
Hironao OTSUBO <motemen@gmail.com>
Hiroshi Ioka <hirochachacha@gmail.com>
Hitoshi Mitake <mitake.hitoshi@gmail.com>
Holden Huang <ttyh061@gmail.com>
Hong Ruiqi <hongruiqi@gmail.com>
Hongfei Tan <feilengcui008@gmail.com>
Horst Rutter <hhrutter@gmail.com>
Hossein Sheikh Attar <hattar@google.com>
Hsin Tsao <tsao@google.com>
Hsin-Ho Yeh <yhh92u@gmail.com>
Hu Keping <hukeping@huawei.com>
Hugues Bruant <hugues.bruant@gmail.com>
Huy Le <huy.dinh.le.89@gmail.com>
Hyang-Ah
Hana Kim <hakim@google.com> <hyangah@gmail.com>
Ian Cottrell <iancottrell@google.com>
Ian Davis <nospam@iandavis.com>
Ian Gudger <ian@loosescre.ws>
Ian Haken <ihaken@netflix.com>
Ian Kent <iankent85@gmail.com>
Ian Lance Taylor <iant@golang.org>
Ian Leue <ian@appboy.com>
Ian Zapolsky <ianzapolsky@gmail.com>

Ibrahim AshShohail <ibra.sho@gmail.com>
Icarus Sparry <golang@icarus.freeuk.com>
Iccha Sethi <icchasethi@gmail.com>
Idora Shinatose <idora.shinatose@gmail.com>
Igor Bernstein <igorbernstein@google.com>
Igor Dolzhikov <bluesriverz@gmail.com>
Igor Vashyst <ivashyst@gmail.com>
Igor Zhilianin <igor.zhilianin@gmail.com>
Illya Yalovyy <yalovoy@gmail.com>
Ilya Tocar <ilya.tocar@intel.com>
INADA Naoki <songofacandy@gmail.com>
Inanc Gumus <m@inanc.io>
Ingo Gottwald <in.gottwald@gmail.com>
Ingo Krabbe <ikrabbe.ask@gmail.com>
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>
Ioannis Georgoulas <geototti21@hotmail.com>
Irfan Sharif <irfanmahmoudsharif@gmail.com>
Irieda Noboru
<irieda@gmail.com>
Isaac Ardis <isaac.ardis@gmail.com>
Isaac Wagner <ibw@isaacwagner.me>
Iskander Sharipov <iskander.sharipov@intel.com> <quasilyte@gmail.com>
Issac Trotts <issactrotts@google.com>
Ivan Babrou <ivan@cloudflare.com>
Ivan Bertona <ivan.bertona@gmail.com>
Ivan Krasin <krasin@golang.org>
Ivan Kutuzov <arbrix@gmail.com>
Ivan Markin <sw@nogoegst.net>
Ivan Moscoso <moscoso@gmail.com>
Ivan Osadchii <ivan.osadchii@gmail.com>
Ivan Sharavuev <shpiwan@gmail.com>
Ivan Ukhov <ivan.ukhov@gmail.com>
Ivy Evans <ivy@ivyevans.net>
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>
Jack Britton <jackxbritton@gmail.com>
Jack Lindamood <jlindamo@justin.tv>
Jacob Baskin <jbaskin@google.com>
Jacob Blain Christen <dweomer5@gmail.com>
Jacob H. Haven <jacob@cloudflare.com>
Jacob Hoffman-Andrews <github@hoffman-andrews.com>
Jacob Walker <jacobwalker0814@gmail.com>
Jae Kwon <jae@tendermint.com>
Jake B <doogie1012@gmail.com>
Jakob Borg <jakob@nym.se>
Jakob Weisblat <jakobw@mit.edu>
Jakub
ajka <jcajka@redhat.com>
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>

James Aguilar <jaguilar@google.com>
James Bardin <j.bardin@gmail.com>
James Chacon <jchacon@google.com>
James Clarke <jrtc27@jrtc27.com>
James Cowgill <James.Cowgill@imgtec.com>
James Craig Burley <james-github@burleyarch.com>
James David Chalfant <james.chalfant@gmail.com>
James Eady <jmeady@google.com>
James Fysh <james.fysh@gmail.com>
James Gray <james@james4k.com>
James Hartig <fastest963@gmail.com>
James Lawrence <jljatone@gmail.com>
James Meneghello <rawrz0r@gmail.com>
James Myers <jfmyers9@gmail.com>
James Neve <jamesoneve@gmail.com>
James Nugent <james@jen20.com>
James P. Cooper <jamespcooper@gmail.com>
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>
James Schofield <james@shoeboxapp.com>
James Smith <jrs1995@icloud.com>
James Sweet <james.sweet88@googlemail.com>
James Toy <nil@opensesame.st>
James Treanor <jtreanor3@gmail.com>
James Tucker <raggi@google.com>
James Whitehead
<jnwhiteh@gmail.com>
Jamie Beverly <jamie.r.beverly@gmail.com>
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>
Jamie Kerr <jkerr113@googlemail.com>
Jamie Liu <jameliu@google.com>
Jamie Stackhouse <contin673@gmail.com>
Jamie Turner <jamwt@dropbox.com>
Jamie Wilkinson <jaq@spacepants.org>
Jamil Djadala <djadala@gmail.com>
Jan Berktold <jan@berktold.co>
Jan H. Hosang <jan.hosang@gmail.com>
Jan Kratochvil <jan.kratochvil@redhat.com>
Jan Lehnardt <jan@apache.org>
Jan Mercl <0xjnm@gmail.com> <befelemepeseveze@gmail.com>
Jan Newmarch <jan.newmarch@gmail.com>
Jan Pilzer <jan.pilzer@gmx.de>
Jan Steinke <jan.steinke@gmail.com>
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>
Jannis Andrija Schnitzer <jannis@schnitzer.im>
Jared Culp <jculp14@gmail.com>
Jaroslav Poepko <jp@webmaster.ms>
Jason A. Donenfeld <Jason@zx2c4.com>

Jason Barnett <jason.w.barnett@gmail.com>
Jason Buberel <jbuberel@google.com>
Jason Chu <jasonchujc@gmail.com>
Jason
Del Ponte <delpontej@gmail.com>
Jason Hall <jasonhall@google.com>
Jason Keene <jasonkeene@gmail.com>
Jason LeBrun <jblebrun@gmail.com>
Jason Smale <jsmale@zendesk.com>
Jason Travis <infomaniac7@gmail.com>
Jason Wangsadinata <jwangsadinata@gmail.com>
Javier Kohen <jkohen@google.com>
Javier Revillas <jrevillas@massivedynamic.io>
Javier Segura <javism@gmail.com>
Jay Conrod <jayconrod@google.com>
Jay Taylor <outtatime@gmail.com>
Jay Weiskopf <jay@jayschwa.net>
Jean de Klerk <deklerk@google.com>
Jean-Andr Santoni <jean.andre.santoni@gmail.com>
Jean-Franois Bustarret <jf@bustarret.com>
Jean-Francois Cantin <jfcantin@gmail.com>
Jean-Marc Eurin <jmeurin@google.com>
Jean-Nicolas Moal <jn.moal@gmail.com>
Jed Denlea <jed@fastly.com>
Jeet Parekh <jeetparekh96@gmail.com>
Jeevanandam M <jeeva@myjeeva.com>
Jeff (Zhefu) Jiang <jeffjiang@google.com>
Jeff Craig <jeffcraig@google.com>
Jeff Dupont <jeff.dupont@gmail.com>
Jeff Hodges <jeff@somethingsimilar.com>
Jeff Johnson <jrjohnson@google.com>
Jeff
R. Allen <jra@nella.org> <jeff.allen@gmail.com>
Jeff Sickel <jas@corpus-callosum.com>
Jeff Wendling <jeff@spacemonkey.com>
Jeffrey H <jeffreyh192@gmail.com>
Jelte Fennema <github-tech@jeltef.nl>
Jens Frederich <jfrederich@gmail.com>
Jeremiah Harmsen <jeremiah@google.com>
Jeremy Banks <_@jeremy.ca>
Jeremy Canady <jcanady@gmail.com>
Jeremy Jackins <jeremyjackins@gmail.com>
Jeremy Jay <jeremy@pbnjay.com>
Jeremy Schlatter <jeremy.schlatter@gmail.com>
Jeroen Bobbeldijk <jrbob92@gmail.com>
Jeroen Simonetti <jeroen@simonetti.nl>
Jerrin Shaji George <jerrinsg@gmail.com>
Jess Frazelle <me@jessfraz.com>

Jesse Szwedko <jesse.szwedko@gmail.com>
Jess Espino <jespinog@gmail.com>
Jianing Yu <jnyu@google.com>
Jianqiao Li <jianqiaoli@google.com>
Jihyun Yu <yjh0502@gmail.com>
Jim Cote <jfcote87@gmail.com>
Jim Kingdon <jim@bolt.me>
Jim McGrath <jimmc2@gmail.com>
Jim Minter <jminter@redhat.com>
Jimmy Frasche <soapboxcicero@gmail.com>
Jimmy Zelinskie <jimmyzelinskie@gmail.com>
Jin-wook Jeong <jeweljar@hanmail.net>
Jingcheng
Zhang <diogin@gmail.com>
Jingguo Yao <yaojingguo@gmail.com>
Jingnan Si <jingnan.si@gmail.com>
Jinkun Zhang <franksnolf@gmail.com>
Jiong Du <londdevil@gmail.com>
Jirka Dank <dnk@mail.muni.cz>
Jiulong Wang <jiulongw@gmail.com>
Joakim Sernbrant <serbaut@gmail.com>
Joe Bowbeer <joe.bowbeer@gmail.com>
Joe Cortopassi <joe@joecortopassi.com>
Joe Farrell <joe2farrell@gmail.com>
Joe Harrison <joehazzers@gmail.com>
Joe Henke <joed.henke@gmail.com>
Joe Kyo <xunianzu@gmail.com>
Joe Poirier <jdpoirier@gmail.com>
Joe Richey <joerichey@google.com>
Joe Shaw <joe@joeshaw.org>
Joe Sylve <joe.sylve@gmail.com>
Joe Tsai <joetsai@digital-static.net>
Joel Sing <joel@sing.id.au> <jsing@google.com>
Jol Stemmer <jstemmer@google.com>
Joel Stemmer <stemmertech@gmail.com>
Joey Geiger <jgeiger@users.noreply.github.com>
Johan Brandhorst <johan.brandhorst@gmail.com>
Johan Euphrosine <proppy@google.com>
Johan Sageryd <j@1616.se>
John Asmuth <jasmuth@gmail.com>
John Beisley <huin@google.com>
John C Barstow
<jbowtie@amathaine.com>
John DeNero <denero@google.com>
John Dethridge <jcd@golang.org>
John Gibb <johngibb@gmail.com>
John Gilik <john@jgilik.com>
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>

John Howard Palevich <jack.palevich@gmail.com>
John Jeffery <jjeffery@sp.com.au>
John Jenkins <twodopeshaggy@gmail.com>
John Leidegren <john.leidegren@gmail.com>
John Moore <johnkenneth.moore@gmail.com>
John Newlin <jnewlin@google.com>
John Potocny <johnp@vividcortex.com>
John R. Lenton <jlenton@gmail.com>
John Schnake <schnake.john@gmail.com>
John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
John Weldon <johnweldon4@gmail.com>
Johnny Luo <johnnyluo1980@gmail.com>
Jon Chen <jchen@justin.tv>
Jonas Bernoulli <jonas@bernoul.li>
Jonathan Allie <jonallie@google.com>
Jonathan Amsterdam <jba@google.com>
Jonathan Boulle <jonathanboulle@gmail.com>
Jonathan Chen <dijonkitchen@users.noreply.github.com>
Jonathan Feinberg <feinberg@google.com>
Jonathan Gold <jgold.bg@gmail.com>
Jonathan
Hseu <jhseu@google.com>
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>
Jonathan Nieder <jrn@google.com>
Jonathan Pentecost <pentecostjonathan@gmail.com>
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>
Jonathan Rudenberg <jonathan@titanous.com>
Jonathan Stacks <jonstacks13@gmail.com>
Jonathan Wills <runningwild@gmail.com>
Jonathon Lacher <jonathon.lacher@gmail.com>
Jongmin Kim <atomaths@gmail.com>
Joonas Kuorilehto <joneskoo@derbian.fi>
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>
Jordan Krage <jmank88@gmail.com>
Jordan Lewis <jordanthelewis@gmail.com>
Jordan Liggitt <liggitt@google.com>
Jordan Rhee <jordanrh@microsoft.com>
Jordi Martin <jordimartin@gmail.com>
Jorge Araya <jorgejavieran@yahoo.com.mx>
Jos Visser <josv@google.com>
Jose Luis Vzquez Gonzlez <josvazg@gmail.com>
Joseph Bonneau <jcb@google.com>
Joseph Holsten <joseph@josephholsten.com>
Josh Bleecher Snyder <josharian@gmail.com>
Josh Chorlton <jchorlton@gmail.com>
Josh Deprez <josh.deprez@gmail.com>
Josh

Goebel <dreamer3@gmail.com>
Josh Hoak <jhoak@google.com>
Josh Holland <jrh@joshh.co.uk>
Josh Roppo <joshroppo@gmail.com>
Josh Varga <josh.varga@gmail.com>
Joshua Boelter <joshua.boelter@intel.com>
Joshua Chase <jcjosuachase@gmail.com>
Joshua M. Clulow <josh.clulow@joyent.com>
Joshua Rubin <joshua@rubixconsulting.com>
Josselin Costanzi <josselin@costanzi.fr>
Jostein Stuhauug <js@solidsystem.no>
JP Sugarbroad <jpsugar@google.com>
JT Olds <jtolds@xnet5.com>
JT Olio <hello@jtolio.com>
Juan Carlos <juanjcsr@gmail.com>
Juan Pablo Civile <elementohb@gmail.com>
Jude Pereira <judebpereira@gmail.com>
Jukka-Pekka Kekkonen <karatepekka@gmail.com>
Julia Hansbrough <flowerhack@google.com>
Julian Kornberger <jk+github@digineo.de>
Julian Pastarmov <pastarmovj@google.com>
Julian Phillips <julian@quantumfyre.co.uk>
Julie Qiu <julie@golang.org>
Julien Kauffmann <julien.kauffmann@freelan.org>
Julien Salleyron <julien.salleyron@gmail.com>
Julien Schmidt <google@julienschmidt.com>
Julio
Montes <julio.montes@intel.com>
Junda Liu <junda@celer.network>
Jungho Ahn <jhahn@google.com>
Junya Hayashi <ledmonster@gmail.com>
Juraj Sukop <sukop@users.noreply.github.com>
Jure Ham <jure.ham@zemanta.com>
Justin Gracenin <jgracenin@gmail.com>
Justin Li <git@justinli.net>
Justin Nu <nuss.justin@gmail.com>
Justyn Temme <justyntemme@gmail.com>
Kelly Heller <pestophagous@gmail.com>
Kai Backman <kaib@golang.org>
Kai Dong <dokia2357@gmail.com>
Kai Trukenmller <ktye78@gmail.com>
Kale Blankenship <kale@lemnisis.com>
Kaleb Elwert <kelwert@atlassian.com>
Kamal Aboul-Hosn <aboulhosn@google.com>
Kamil Chmielewski <kamil.chm@gmail.com>
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>
Kamil Rytarowski <krytarowski@users.noreply.github.com>
Kang Hu <hukangustc@gmail.com>

Karan Dhiman <karandhi@ca.ibm.com>
Karel Pazdera <pazderak@gmail.com>
Karoly Negyesi <chx1975@gmail.com>
Karsten Khler <karsten.koehler95@gmail.com>
Karthik Nayak <karthik.188@gmail.com>
Kashav Madan <kshvmdn@gmail.com>
Kate
Manson <kate.manson@izettle.com>
Katie Hockman <katie@golang.org>
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>
Katrina Owen <katrina.owen@gmail.com>
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>
Kay Zhu <kayzhu@google.com>
Kazuhiro Sera <seratch@gmail.com>
KB Sriram <kbsriram@google.com>
Keegan Carruthers-Smith <keegan.csmith@gmail.com>
Kei Son <hey.calmdown@gmail.com>
Keiji Yoshida <keijiyoshida.mail@gmail.com>
Keith Ball <inflatablewoman@gmail.com>
Keith Randall <khr@golang.org>
Keith Rarick <kr@xph.us>
Kelsey Hightower <kelsey.hightower@gmail.com>
Kelvin Foo Chuan Lyi <vmirage@gmail.com>
Ken Friedenbach <kenliz@cruzio.com>
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>
Ken Sedgwick <ken@bonsai.com>
Ken Thompson <ken@golang.org>
Kenichi Tsunokawa <kenichi.tsunokawa@gmail.com>
Kenji Kaneda <kenji.kaneda@gmail.com>
Kenji Yano <kenji.yano@gmail.com>
Kenneth Shaw <kenshaw@gmail.com>
Kenny Grant <kennygrant@gmail.com>
Kenta Mori <zoncoen@gmail.com>
Ketan Parmar <ketanbparmar@gmail.com>
Kevin
Ballard <kevin@sb.org>
Kevin Burke <kev@inburke.com>
Kevin Gillette <extemporalgenome@gmail.com>
Kevin Kirsche <kev.kirsche@gmail.com>
Kevin Klues <klueska@gmail.com> <klueska@google.com>
Kevin Malachowski <chowski@google.com>
Kevin Ruffin <kruffin@gmail.com>
Kevin Vu <kevin.m.vu@gmail.com>
Kevin Zita <bleedgreenandgold@gmail.com>
Kieran Colford <kieran@kcolford.com>
Kim Shrier <kshrier@racktopsystems.com>
Kim Yongbin <kybinz@gmail.com>
Kir Kolyshkin <kolyshkin@gmail.com>

Kirill Motkov <Motkov.Kirill@gmail.com>
Kirill Smelkov <kirr@nexedi.com>
Kirk Han <kirk91.han@gmail.com>
Kirklin McDonald <kirklin.mcdonald@gmail.com>
Klaus Post <klauspost@gmail.com>
Kodie Goodwin <kodiegoodwin@gmail.com>
Koichi Shiraishi <zchee.io@gmail.com>
Koki Ide <niconegoto@yahoo.co.jp>
Komu Wairagu <komuw05@gmail.com>
Konstantin <konstantin8105@gmail.com>
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>
Kris Kwiatkowski <kris@cloudflare.com>
Kris Nova <kris@nivenly.com>
Kris Rousey <krousey@google.com>
Kristopher
Watts <traetox@gmail.com>
Kshitij Saraogi <kshitij@saraogi@gmail.com>
Kun Li <likunarmstrong@gmail.com>
Kunpei Sakai <namusyaka@gmail.com>
Kuntal Majumder <hellozee@disroot.org>
Kyle Consalus <consalus@gmail.com>
Kyle Isom <kyle@gokyle.net>
Kyle Jones <kyle@kyledj.com>
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>
Kyle Shannon <kyle@pobox.com>
Kyle Spiers <eiais@google.com>
Kyle Wood <kyle@kylewood.cc>
Kyohei Kadota <lufia@lufia.org>
Kyrylo Silin <silin@kyrylo.org>
L Campbell <unpantso@gmail.com>
Lai Jiangshan <eag0628@gmail.com>
Lajos Papp <lalyos@yahoo.com>
Lakshay Garg <lakshay.garg.1996@gmail.com>
Lann Martin <lanm@google.com>
Lanre Adelowo <yo@lanre.wtf>
Larry Clapp <larry@theclapp.org>
Larry Hosken <lahosken@golang.org>
Lars Jeppesen <jeppesen.lars@gmail.com>
Lars Lehtonen <lars.lehtonen@gmail.com>
Lars Wiegman <lars@namsral.com>
Larz Conwell <larzconwell@gmail.com>
Laurent Voisin <lpvoisin@gmail.com>
Laurie Clark-Michalek <laurie@qubit.com>
LE Manh Cuong
<cuong.manhle.vn@gmail.com>
Lee Hinman <hinman@gmail.com>
Lee Packham <lpackham@gmail.com>
Lehner Florian <dev@der-flo.net>

Leigh McCulloch <leighmcc@gmail.com>
Leo Antunes <leo@costela.net>
Leo Rudberg <ljr@google.com>
Leon Klingele <git@leonklingele.de>
Leonardo Comelli <leonardo.comelli@gmail.com>
Leonel Quinteros <leonel.quinteros@gmail.com>
Lev Shamardin <shamardin@gmail.com>
Lewin Bormann <lewin.bormann@gmail.com>
Lion Yang <lion@aosc.xyz>
Lloyd Dewolf <foolswisdom@gmail.com>
Lorenz Bauer <lmb@cloudflare.com>
Lorenz Nickel <mail@lorenznickel.de>
Lorenzo Masini <rugginoso@develer.com>
Lorenzo Stoakes <lstoakes@gmail.com>
Louis Kruger <louisk@google.com>
Luan Santos <cfcluan@gmail.com>
Lubomir I. Ivanov <neolit123@gmail.com>
Luca Bruno <luca.bruno@coreos.com>
Luca Greco <luca.greco@alcacoop.it>
Lucas Bremgartner <lucas.bremgartner@gmail.com>
Lucas Clemente <lclemente@google.com>
Lucien Stuker <lucien.stuker@gmail.com>
Lucio De Re <lucio.dere@gmail.com>
Ludi Rehak <ludi317@gmail.com>
Luigi
Riefolo <luigi.riefolo@gmail.com>
Luit van Drongelen <luitvd@gmail.com>
Luka Zakrajek <tr00.g33k@gmail.com>
Luka Zitnik <luka.zitnik@gmail.com>
Lukasz Milewski <lmmilewski@gmail.com>
Luke Champine <luke.champine@gmail.com>
Luke Curley <qpingu@gmail.com>
Luke Granger-Brown <git@lukegb.com>
Luna Duclos <luna.duclos@palmstonegames.com>
Luuk van Dijk <lvd@golang.org> <lvd@google.com>
Lyle Franklin <lylejfranklin@gmail.com>
Lynn Boger <laboger@linux.vnet.ibm.com>
Ma Peiqi <mapeiqi2017@gmail.com>
Maarten Bezemer <maarten.bezemer@gmail.com>
Maciej Dbski <maciejd@google.com>
Madhu Rajanna <madhupr007@gmail.com>
Magnus Hiie <magnus.hiie@gmail.com>
Maicon Costa <maiconscosta@gmail.com>
Mak Kolybabi <mak@kolybabi.com>
Maksym Trykur <maksym.trykur@gmail.com>
Mal Curtis <mal@mal.co.nz>
Manfred Touron <m@42.am>
Manigandan Dharmalingam <manigandan.jeff@gmail.com>

Manish Goregaokar <manishsmail@gmail.com>
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>
Mansour Rahimi <rahimi.mnr@gmail.com>
Manu
Garg <manugarg@google.com>
Manu S Ajith <neo@codingarena.in>
Manuel Mendez <mmendez534@gmail.com>
Marat Khabibullin <marat.khabibullin@jetbrains.com>
Marc Weistroff <marc@weistroff.net>
Marc-Antoine Ruel <maruel@chromium.org>
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>
Marcel van Lohuizen <mpvl@golang.org>
Marcelo Cantos <marcelo.cantos@gmail.com>
Marcelo E. Magallon <marcelo.magallon@gmail.com>
Marco Hennings <marco.hennings@freiheit.com>
Marcus Willock <crazcalm@gmail.com>
Marga Manterola <marga@google.com>
Marin Bai <marin.basic02@gmail.com>
Mario Arranz <marioarranzr@gmail.com>
Marius A. Eriksen <marius@grailbio.com>
Marius Nuennerich <mnu@google.com>
Mark Adams <mark@markadams.me>
Mark Bucciarelli <mkbucc@gmail.com>
Mark Glines <mark@glines.org>
Mark Harrison <marhar@google.com>
Mark Percival <m@mdp.im>
Mark Pulford <mark@kyne.com.au>
Mark Rushakoff <mark.rushakoff@gmail.com>
Mark Ryan <mark.d.ryan@intel.com>
Mark Severson <miquella@gmail.com>
Mark
Theunissen <mark.theunissen@gmail.com>
Mark Villacampa <m@markvillacampa.com>
Mark Wolfe <mark@wolfe.id.au>
Mark Zavislak <zavislak@google.com>
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>
Marko Kevac <marko@kevac.org>
Marko Mikulicic <mkm@google.com>
Marko Mudrinic <mudrinic.mare@gmail.com>
Marko Tiikkaja <marko@joh.to>
Markus Duft <markus.duft@salomon.at>
Markus Sonderegger <marraison@gmail.com>
Markus Zimmermann <zimmski@gmail.com>
Marten Seemann <martenseemann@gmail.com>
Martin Bertschler <mbertschler@gmail.com>
Martin Garton <garton@gmail.com>
Martin Habbecke <marhab@google.com>
Martin Hamrle <martin.hamrle@gmail.com>

Martin Hoefling <martin.hoefling@gmx.de>
Martin Kreichgauer <martinkr@google.com>
Martin Kunc <martinkunc@users.noreply.github.com>
Martin Lindhe <martin.j.lindhe@gmail.com>
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>
Martin Neubauer <m.ne@gmx.net>
Martin Olsen <github.com@martinolsen.net>
Martin Olsson <martin@minimum.se>
Martin Probst <martin@probst.io>
Martin
Sucha <anty.sk+git@gmail.com>
Martin Tournoij <martin@arp242.net>
Martins Sipenko <martins.sipenko@gmail.com>
Martynas Budrinas <mabu@google.com>
Marvin Stenger <marvin.stenger94@gmail.com>
Marwan Sulaiman <marwan.sulaiman@work.co>
Maryan Hratson <gmarik@gmail.com>
Masahiro Furudate <masahiro.furudate@gmail.com>
Masahiro Wakame <vvakame@gmail.com>
Masaki Yoshida <yoshida.masaki@gmail.com>
Mat Byczkowski <mbyczkowski@gmail.com>
Mat Ryer <thatmatryer@gmail.com>
Mt Gulys <mgulyas86@gmail.com>
Matej Bao <matejbaco@gmail.com>
Mateus Amin <mateus.amin@gmail.com>
Mateusz Czapliski <czapkofan@gmail.com>
Mathias Beke <git@denbeke.be>
Mathias Hall-Andersen <mathias@hall-andersen.dk>
Mathias Leppich <mleppich@muhqu.de>
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>
Matt Aimonetti <mattaimonetti@gmail.com>
Matt Blair <me@matthewblair.net>
Matt Bostock <matt@mattbostock.com>
Matt Brown <mbrown@google.com>
Matt Dee <mdee@hioscar.com>
Matt
Drollette <matt@drollette.com>
Matt Harden <matt.harden@gmail.com>
Matt Jibson <matt.jibson@gmail.com>
Matt Joiner <anacrolix@gmail.com>
Matt Jones <mrjones@google.com>
Matt Juran <thepciet@gmail.com>
Matt Layher <mdlayher@gmail.com>
Matt Reiferson <mreiferson@gmail.com>
Matt Robenolt <matt@ydekproductions.com>
Matt Strong <mstrong1341@gmail.com>
Matt T. Proud <matt.proud@gmail.com>

Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>
Matthew Brennan <matty.brennan@gmail.com>
Matthew Broberg <matthewbbroberg@gmail.com>
Matthew Cottingham <mattcottingham@gmail.com>
Matthew Dempsky <mdempsky@google.com>
Matthew Denton <mdenton@skyportsystems.com>
Matthew Holt <Matthew.Holt+git@gmail.com>
Matthew Horsnell <matthew.horsnell@gmail.com>
Matthew Waters <mwwaters@gmail.com>
Mathieu Hauglustaine <matt.hauglustaine@gmail.com>
Mathieu Olivier <olivier.matthieu@gmail.com>
Matthijs Kooijman <matthijs@stdin.nl>
Max Riveiro <kavu13@gmail.com>
Max Schmitt <max@schmitt.mx>
Max Semenik
<maxsem.wiki@gmail.com>
Max Ushakov <ushmax@gmail.com>
Maxim Eryomenko <moeryomenko@gmail.com>
Maxim Khitrov <max@mxcrypt.com>
Maxim Pimenov <mpimenov@google.com>
Maxim Ushakov <ushakov@google.com>
Maxime de Roucy <maxime.deroucy@gmail.com>
Mximo Cuadros Ortiz <mcuadros@gmail.com>
Maxwell Krohn <themax@gmail.com>
Maya Rashish <maya@NetBSD.org>
Mayank Kumar <krmayankk@gmail.com>
Meir Fischer <meirfischer@gmail.com>
Meng Zhuo <mengzhuo1203@gmail.com>
Mhd Sulhan <m.shulhan@gmail.com>
Micah Stetson <micah.stetson@gmail.com>
Michael Anthony Knyszczek <mknyszczek@google.com>
Michael Brandenburg <mbrandenburg@bolste.com>
Michael Chaten <mchaten@gmail.com>
Michael Cook <code@mdcook.net>
Michael Darakananda <pongad@google.com>
Michael Dorner <mail@michaeldorner.de>
Michael Edwards <medwards@walledcity.ca>
Michael Elkins <michael.elkins@gmail.com>
Michael Ellis <micellis@justin.tv>
Michael Fraenkel <michael.fraenkel@gmail.com>
Michael Fromberger <michael.j.fromberger@gmail.com>
Michael Gehring <mg@ebfe.org>
<gnirheg.leahcim@gmail.com>
Michael Henderson <mdhender@users.noreply.github.com>
Michael Hendricks <michael@ndrix.org>
Michael Hoisie <hoisie@gmail.com>
Michael Hudson-Doyle <michael.hudson@linaro.org>
Michael Kasch <michael.kasch@gmail.com>

Michael Kufel <golang@c.michael-kaeufl.de>
Michael Kelly <mjk@google.com>
Michael Lewis <mikelikespie@gmail.com>
Michael MacInnis <Michael.P.MacInnis@gmail.com>
Michael Marineau <michael.marineau@coreos.com>
Michael Matloob <matloob@google.com>
Michael McConville <momconville@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Michael McLoughlin <mmcloughlin@gmail.com>
Michael Munday <mike.munday@ibm.com>
Michael Pearson <mipearson@gmail.com>
Michael Piatek <piatek@google.com>
Michael Pratt <mpratt@google.com>
Michael Schaller <michael@5challer.de>
Michael Schurter <michael.schurter@gmail.com>
Michael Shields <mshields@google.com>
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>
Michael Steinert <mike.steinert@gmail.com>
Michael
T. Jones <mtj@google.com> <michael.jones@gmail.com>
Michael Teichgraber <mteichgraber@gmx.de> <mt4swm@googlemail.com>
Michael Traver <mtraver@google.com>
Michael Vetter <g.bluehut@gmail.com>
Michael Vogt <mvo@ubuntu.com>
Michal Bohuslvek <mbohuslvek@gmail.com>
Michal Cierniak <cierniak@google.com>
Micha Derkacz <ziutek@inet.pl>
Michal Franc <lam.michal.franc@gmail.com>
Michal Pristas <michal.pristas@gmail.com>
Michal Rostecki <mrostecki@suse.de>
Michalis Kargakis <michaliskargakis@gmail.com>
Michel Lespinasse <>walken@google.com>
Mickael Kerjean <mickael.kerjean@gmail.com>
Mickey Reiss <mickeyreiss@gmail.com>
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>
Miguel Mendez <stxmendez@gmail.com>
Miguel Molina <hi@mvader.me>
Mihai Borobocea <MihaiBorobocea@gmail.com>
Mihai Moldovan <ionic@ionic.de>
Mihai Todor <todormihai@gmail.com>
Mihail Minaev <minaev.mike@gmail.com>
Mikael Tillenius <mikti42@gmail.com>
Mike Andrews <mra@xoba.com>
Mike Appleby <mike@app.leby.org>
Mike
Danese <mikedanese@google.com>
Mike Houston <mike@kothar.net>
Mike Kabischev <kabischev@gmail.com>

Mike Rosset <mike.rosset@gmail.com>
Mike Samuel <mikesamuel@gmail.com>
Mike Solomon <msolo@gmail.com>
Mike Strosaker <strosake@us.ibm.com>
Mike Tsao <mike@sowbug.com>
Mike Wiacek <mjwiacek@google.com>
Mikhail Gusarov <dottedmag@dottedmag.net>
Mikhail Panchenko <m@mihasya.com>
Miki Tebeka <miki.tebeka@gmail.com>
Mikio Hara <mikioh.mikioh@gmail.com>
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>
Mikoaj Baranowski <mikolajb@gmail.com>
Milan Knezevic <milan.knezevic@mips.com>
Milutin Jovanovic <jovanovic.milutin@gmail.com>
MinJae Kwon <mingrammer@gmail.com>
Miquel Sabat Sol <mikisabate@gmail.com>
Mirko Hansen <baaazen@gmail.com>
Miroslav Genov <mgenov@gmail.com>
Misty De Meo <mistydemeo@gmail.com>
Mohit Agarwal <mohit@sdf.org>
Mohit kumar Bajoria <mohitbajo36@gmail.com>
Momchil Velikov <momchil.velikov@gmail.com>
Monis Khan <mkhan@redhat.com>
Monty Taylor <mordred@inaugust.com>
Moriyoshi
Koizumi <mozo@mozo.jp>
Morten Siebuhr <sbhr@sbhr.dk>
Mshe van der Sterre <moshevds@gmail.com>
Mostyn Bramley-Moore <mostyn@antipode.se>
Mrunal Patel <mrunalp@gmail.com>
Muhammad Falak R Wani <falakreyaz@gmail.com>
Muhammed Uluyol <uluyol0@gmail.com>
Muir Manders <muir@mnd.rs>
Mura Li <mura_li@castech.com.tw>
Mykhailo Lesyk <mikhail@lesyk.org>
Nan Deng <monnand@gmail.com>
Nao Yonashiro <owan.orisano@gmail.com>
Naoki Kanatani <k12naoki@gmail.com>
Nate Wilkinson <nathanwilk7@gmail.com>
Nathan Cantelmo <n.cantelmo@gmail.com>
Nathan Caza <mastercactapus@gmail.com>
Nathan Humphreys <nkhumphreys@gmail.com>
Nathan John Youngman <nj@nathany.com>
Nathan Otterness <otterness@cs.unc.edu>
Nathan P Finch <nate.finch@gmail.com>
Nathan VanBenschoten <nvanbenschoten@gmail.com>
Nathan Youngman <git@nathany.com>
Nathan(yinian) Hu <nathanhu@google.com>

Nathaniel Cook <nvcook42@gmail.com>
Naveen Kumar Sangi <naveenkumarsangi@protonmail.com>
Neelesh Chandola <neelesh.c98@gmail.com>
Neil Lyons <nwjlyons@googlemail.com>
Neuman
Vong <neuman.vong@gmail.com>
Neven Sajko <nsajko@gmail.com>
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>
Niall Sheridan <nsheridan@gmail.com>
Nic Day <nic.day@me.com>
Nicholas Katsaros <nick@nickkatsaros.com>
Nicholas Maniscalco <nicholas@maniscalco.com>
Nicholas Ng <nickng@nickng.io>
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>
Nicholas Sullivan <nicholas.sullivan@gmail.com>
Nicholas Waples <nwaples@gmail.com>
Nick Anthony <Liberatys@outlook.com>
Nick Cooper <nmvc@google.com>
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>
Nick Harper <nharper@google.com>
Nick Kubala <nkubala@google.com>
Nick Leli <nicholasleli@gmail.com>
Nick Miyake <nmiyake@users.noreply.github.com>
Nick Patavalis <nick.patavalis@gmail.com>
Nick Petroni <npetroni@cs.umd.edu>
Nick Robinson <nrobinson13@gmail.com>
Nick Smolin <nick27surgut@gmail.com>
Nicolas BRULEZ <n.brulez@gmail.com>
Nicolas Kaiser <nikai@nikai.net>
Nicolas Owens <mischief@offblast.org>
Nicolas S. Dade
<nic.dade@gmail.com>
Niek Sanders <niek.sanders@gmail.com>
Niels Widger <niels.widger@gmail.com>
Nigel Kerr <nigel.kerr@gmail.com>
Nigel Tao <nigeltao@golang.org>
Nik Nyby <nnyby@columbia.edu>
Nikhil Benesch <nikhil.benesch@gmail.com>
Nikita Kryuchkov <nkryuchkov10@gmail.com>
Niklas Schnelle <niklas.schnelle@gmail.com>
Niko Dziemba <niko@dziemba.com>
Nikolay Turpitko <nikolay@turpitko.com>
Nils Larsgrd <nilsmagnus@gmail.com>
Nir Soffer <nirsof@gmail.com>
Niranjan Godbole <niranjan8192@gmail.com>
Nishanth Shanmugham <nishanth.gerrard@gmail.com>
Noah Campbell <noahcampbell@gmail.com>
Noble Johnson <noblepoly@gmail.com>

Nodir Turakulov <nodir@google.com>
Noel Georgi <git@frezbo.com>
Norberto Lopes <nlopes.ml@gmail.com>
Norman B. Lancaster <qbradq@gmail.com>
Odin Ugedal <odin@ugedal.com>
Oleg Bulatov <dmage@yandex-team.ru>
Oleg Vakheta <helginet@gmail.com>
Oleku Konko <oleku.konko@gmail.com>
Oling Cat <olingcat@gmail.com>
Oliver Hookins <ohookins@gmail.com>
Oliver Stenbom <ostenbom@pivotal.io>
Oliver
Tonnhofer <olt@bogosoftware.com>
Olivier Antoine <olivier.antoine@gmail.com>
Olivier Duperray <duperray.olivier@gmail.com>
Olivier Poitrey <rs@dailymotion.com>
Olivier Saingre <osaingre@gmail.com>
Omar Jarjur <ojarjur@google.com>
Oryan Moshe <iamoryanmoshe@gmail.com>
Osamu TONOMORI <osamingo@gmail.com>
zgr Kesim <oec-go@kesim.org>
Pablo Lalloni <plalloni@gmail.com>
Pablo Rozas Larraondo <pablo.larraondo@anu.edu.au>
Pablo Santiago Blum de Aguiar <scorpus@gmail.com>
Padraig Kitterick <padraigkitterick@gmail.com>
Pallat Anchaleechamaikorn <yod.pallat@gmail.com>
Paolo Giarrusso <p.giarrusso@gmail.com>
Paolo Martini <mrtnpaolo@gmail.com>
Parker Moore <parkrmoore@gmail.com>
Parminder Singh <parmsingh101@gmail.com>
Pascal Dierich <pascal@pascaldierich.com>
Pascal S. de Kloe <pascal@quies.net>
Pat Moroney <pat@pat.email>
Patrick Barker <barkerp@vmware.com>
Patrick Crosby <patrick@stathat.com>
Patrick Gavlin <pgavlin@gmail.com>
Patrick Higgins <patrick.allen.higgins@gmail.com>
Patrick
Lee <pattyshack101@gmail.com>
Patrick Mzard <patrick@mezard.eu>
Patrick Mylund Nielsen <patrick@patrickmn.com>
Patrick Pelletier <pp.pelletier@gmail.com>
Patrick Riley <pfr@google.com>
Patrick Smith <pat42smith@gmail.com>
Patrik Lundin <patrik@sigterm.se>
Paul A Querna <paul.querna@gmail.com>
Paul Borman <borman@google.com>
Paul Boyd <boyd.paul2@gmail.com>

Paul Chang <paulchang@google.com>
Paul Hammond <paul@paulhammond.org>
Paul Hankin <paulhankin@google.com>
Paul Jolly <paul@myitcv.org.uk>
Paul Lalonde <paul.a.lalonde@gmail.com>
Paul M Furley <paul@paulfurley.com>
Paul Marks <pmarks@google.com>
Paul Meyer <paul.meyer@microsoft.com>
Paul Nasrat <pnasrat@google.com>
Paul PISCUC <paul.piscuc@gmail.com>
Paul Querna <pquerna@apache.org>
Paul Rosania <paul.rosania@gmail.com>
Paul Ruest <pruest@gmail.com>
Paul Sbarra <Sbarra.Paul@gmail.com>
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>
Paul Tyng <paul@paultyng.net>
Paul van Brouwershaven <paul@vanbrouwershaven.com>
Paul Wankadia <junyer@google.com>
Paulo
Casaretto <pcasaretto@gmail.com>
Paulo Flabiano Smorigo <pfsmorigo@linux.vnet.ibm.com>
Pavel Paulau <pavel.paulau@gmail.com>
Pavel Zinovkin <pavel.zinovkin@gmail.com>
Pavlo Sumkin <ymkins@gmail.com>
Pawel Knap <pawelknap88@gmail.com>
Pawel Szczur <filemon@google.com>
Percy Wegmann <ox.to.a.cart@gmail.com>
Perry Abbott <perry.j.abbott@gmail.com>
Petar Maymoukov <petarm@gmail.com>
Peter Armitage <peter.armitage@gmail.com>
Peter Bourgon <peter@bourgon.org>
Peter Collingbourne <pcc@google.com>
Peter Conerly <pconerly@gmail.com>
Peter Dotchev <dotchev@gmail.com>
Peter Froehlich <peter.hans.froehlich@gmail.com>
Peter Gonda <pgonda@google.com>
Peter Hoyes <pahoyes@gmail.com>
Peter Kleiweg <pkleiweg@xs4all.nl>
Peter McKenzie <petermck@google.com>
Peter Moody <pmoody@uber.com>
Peter Morjan <pmorjan@gmail.com>
Peter Mundy <go.peter.90@gmail.com>
Peter Nguyen <peter@mictis.com>
Pter Surnyi <speter.go1@gmail.com>
Pter Szab <pts@google.com>
Pter Szilgyi <peterke@gmail.com>
Peter

Teichman <pteichman@fastly.com>
Peter Tseng <ptseng@squareup.com>
Peter Waldschmidt <peter@waldschmidt.com>
Peter Waller <peter.waller@gmail.com>
Peter Weinberger <pjw@golang.org>
Peter Williams <pwil3058@gmail.com>
Peter Wu <pwu@cloudflare.com>
Peter Zhang <i@ddatsh.com>
Petr Jedin <petr.jediny@gmail.com>
Petrica Voicu <pvoicu@paypal.com>
Phil Pearl <philip.j.r.pearl@gmail.com>
Phil Pennock <pdp@golang.org>
Philip Brgesen <philip.brgesen@gmail.com>
Philip Brown <phil@bolthole.com>
Philip Hofer <phofer@umich.edu>
Philip K. Warren <pkwarren@gmail.com>
Philip Nelson <me@pnelson.ca>
Philipp Stephani <phst@google.com>
Pierre Durand <pierredurand@gmail.com>
Pierre Prinetti <pierreprinetti@gmail.com>
Pierre Roullon <pierre.roullon@gmail.com>
Piers <google@hellopiers.pro>
Pieter Droogendijk <pieter@binky.org.uk>
Pietro Gagliardi <pietro10@mac.com>
Piyush Mishra <piyush@codeitout.com>
Plekhanov Maxim <kishtatix@gmail.com>
Pontus Leitzler <leitzler@gmail.com>
Prasanna Swaminathan <prasanna@mediamath.com>
Prashant
Varanasi <prashant@prashantv.com>
Pravendra Singh <hackpravj@gmail.com>
Preetam Jinka <pj@preet.am>
Pure White <wu.purewhite@gmail.com>
Qais Patankar <qaisjp@gmail.com>
Qiuxuan Zhu <ilsh1022@gmail.com>
Quan Tran <qeed.quan@gmail.com>
Quan Yong Zhai <qyzhai@gmail.com>
Quentin Perez <qperez@ocs.online.net>
Quentin Renard <contact@asticode.com>
Quentin Smith <quentin@golang.org>
Quinn Slack <sq@sourcegraph.com>
Quinten Yearsley <qyearsley@chromium.org>
Quoc-Viet Nguyen <afelion@gmail.com>
Radek Sohlich <sohlich@gmail.com>
Radu Berinde <radu@cockroachlabs.com>
Rafal Jeczalik <rjeczalik@gmail.com>
Raghavendra Nagaraj <jamdagni86@gmail.com>
Rahul Chaudhry <rahulchaudhry@chromium.org>

Raif S. Naffah <go@naffah-raif.name>
Rajat Goel <rajat.goel2010@gmail.com>
Rajath Agasthya <rajathagasthya@gmail.com>
Rajender Reddy Kompally <rajenderreddykompally@gmail.com>
Ralph Corderoy <ralph@inputplus.co.uk>
Ramazan AYYILDIZ <rayyildiz@gmail.com>
Ramesh Dharan <dharan@google.com>
Raph
Levien <raph@google.com>
Raphael Geronimi <raphael.geronimi@gmail.com>
Raul Silvera <rsilvera@google.com>
Ravil Bikbulatov <weeellz12@gmail.com>
RaviTeja Pothana <ravi.tezu@gmail.com>
Ray Tung <rtung@thoughtworks.com>
Raymond Kazlauskas <raima220@gmail.com>
Rebecca Stambler <rstambler@golang.org>
Reilly Watson <reillywatson@gmail.com>
Reinaldo de Souza Jr <juniorz@gmail.com>
Remi Gillig <remigillig@gmail.com>
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>
Rens Rikkerink <Ikkerens@users.noreply.github.com>
Rhys Hiltner <rhys@justin.tv>
Ricardo Padilha <ricardospadilha@gmail.com>
Richard Barnes <rlb@ipv.sx>
Richard Crowley <r@rcrowley.org>
Richard Dingwall <rdingwall@gmail.com>
Richard Eric Gavaletz <gavaletz@gmail.com>
Richard Gibson <richard.gibson@gmail.com>
Richard Miller <miller.research@gmail.com>
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>
Rick Arnold <rickarnoldjr@gmail.com>
Rick Hudson <rlh@golang.org>
Rick Sayre <whorfin@gmail.com>
Rijnard
van Tonder <rvantonder@gmail.com>
Riku Voipio <riku.voipio@linaro.org>
Risto Jaakko Saarelm <rsaarelm@gmail.com>
Rob Earhart <earhart@google.com>
Rob Norman <rob.norman@infinitycloud.com>
Rob Phoenix <rob@robphoenix.com>
Rob Pike <r@golang.org>
Robert Ayrapetyan <robert.ayrapetyan@gmail.com>
Robert Daniel Kortschak <dan.kortschak@adelaide.edu.au> <dan@kortschak.io>
Robert Dinu <r@varp.se>
Robert Figueiredo <robfig@gmail.com>
Robert Griesemer <gri@golang.org>
Robert Hencke <robert.hencke@gmail.com>
Robert Iannucci <iannucci@google.com>

Robert Obryk <robryk@gmail.com>
Robert Seseek <rseseek@google.com>
Robert Snedegar <roberts@google.com>
Robert Stepanek <robert.stepanek@gmail.com>
Robert van Gent <rvangent@google.com>
Robert-Andr Mauchin <zebob.m@gmail.com>
Roberto Clapis <robclap8@gmail.com>
Roberto Selbach <roberto@selbach.ca>
Robin Eklind <r.eklind.87@gmail.com>
Rodolfo Carvalho <rhcavalho@gmail.com>
Rodolfo Rodriguez <rodolfobgibson@gmail.com>
Rodrigo Moraes de Oliveira
<rodrigo.moraes@gmail.com>
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>
Roger Pau Monn <royger@gmail.com>
Roger Peppe <rogpeppe@gmail.com>
Rohan Verma <rohanverma2004@gmail.com>
Roland Illig <roland.illig@gmx.de>
Roland Shoemaker <rolandshoemaker@gmail.com>
Romain Bauge <romain.bauge@elwinar.com>
Roman Budnikov <romanyx90@yandex.ru>
Roman Shchekin <mrqtros@gmail.com>
Ron Hashimoto <mail@h2so5.net>
Ron Minnich <rminnich@gmail.com>
Ross Chater <rdchater@gmail.com>
Ross Light <light@google.com> <rlight2@gmail.com>
Ross Smith II <ross@smithii.com>
Rowan Marshall <rowanajmarshall@gmail.com>
Rowan Worth <sqweek@gmail.com>
Rudi Kramer <rudi.kramer@gmail.com>
Rui Ueyama <ruiui@google.com>
Ruslan Nigmatullin <elessar@dropbox.com>
Russ Cox <rsc@golang.org>
Russell Haering <russellhaering@gmail.com>
Ryan Bagwell <ryanbagwell@outlook.com>
Ryan Barrett <ryanb@google.com>
Ryan Boehning <ryan.boehning@apcera.com>
Ryan Brown <ribrd@b@gmail.com>
Ryan Canty <jrcanty@gmail.com>
Ryan Dahl <ry@tinyclouds.org>
Ryan
Hitchman <hitchmanr@gmail.com>
Ryan Lower <rpjlower@gmail.com>
Ryan Roden-Corrent <ryan@rcorre.net>
Ryan Seys <ryan@ryanseys.com>
Ryan Slade <ryanslade@gmail.com>
Ryan Zhang <ryan.zhang@docker.com>
Ryoichi KATO <ryo1kato@gmail.com>

Ryuji Iwata <qt.luigi@gmail.com>
Ryuma Yoshida <ryuma.y1117@gmail.com>
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>
S.alar Onur <caglar@10ur.org>
Sabin Mihai Rapan <sabin.rapan@gmail.com>
Sad Pencil <qh06@qq.com>
Sai Cheemalapati <saicheems@google.com>
Sakeven Jiang <jc5930@sina.cn>
Salmn Aljammz <s@0x65.net>
Sam Arnold <sarnold64@bloomberg.net>
Sam Boyer <tech@samboyer.org>
Sam Ding <samding@ca.ibm.com>
Sam Hug <samuel.b.hug@gmail.com>
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>
Sam Whited <sam@samwhited.com>
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>
Sami Commerot <samic@google.com>
Sami Pnknen <sami.ponkanen@gmail.com>
Samuel Kelemen <SCKelemen@users.noreply.github.com>
Samuel Tan <samueltan@google.com>
Samuele
Pedroni <pedronis@lucediurna.net>
Sander van Harmelen <sander@vanharmelen.nl>
Sanjay Menakuru <balasanjay@gmail.com>
Santhosh Kumar Tekuri <santhosh.tekuri@gmail.com>
Sarah Adams <shadams@google.com>
Sascha Brawer <sascha@brawer.ch>
Sasha Lionheart <lionhearts@google.com>
Sasha Sobol <sasha@scaledinference.com>
Scott Barron <scott.barron@github.com>
Scott Bell <scott@sctsm.com>
Scott Crunkleton <crunk1@gmail.com>
Scott Ferguson <scottwferg@gmail.com>
Scott Lawrence <bytbody@gmail.com>
Scott Mansfield <smansfield@netflix.com>
Scott Schwartz <scotts@golang.org>
Scott Van Woudenberg <scottvw@google.com>
Sean Burford <sburford@google.com>
Sean Chen <oohcode@gmail.com>
Sean Chittenden <seanc@joyent.com>
Sean Christopherson <sean.j.christopherson@intel.com>
Sean Dolphin <Sean.Dolphin@kpccompass.com>
Sean Harger <sharger@google.com>
Sean Rees <sean@erifax.org>
Sebastiaan van Stijn <github@gone.nl>
Sebastian Schmidt <yath@google.com>
Sebastien Binet <seb.binet@gmail.com>
Sbastien Paolacci <sebastien.paolacci@gmail.com>

Sebastien

Williams-Wynn <sebastien@cytora.com>
Segev Finer <segev208@gmail.com>
Seiji Takahashi <timaki.st@gmail.com>
Sergei Skorobogatov <skorobo@rambler.ru>
Sergei Zagurskii <gvozdoder@gmail.com>
Sergey 'Snake' Gromov <snake.scaly@gmail.com>
Sergey Arseev <sergey.arseev@intel.com>
Sergey Dobrodey <sergey.dobrodey@synesis.ru>
Sergey Frolov <sfrolov@google.com>
Sergey Lukjanov <me@slukjanov.name>
Sergey Mishin <sergeymishine@gmail.com>
Sergey Mudrik <sergey.mudrik@gmail.com>
Sergey Semin <gray12511@gmail.com>
Sergey Yanykin <syanykin@ozon.ru>
Sergio Luis O. B. Correia <sergio@correia.cc>
Sergiusz Bazanski <bazanski@gmail.com>
Serhii Aheienko <serhii.aheienko@gmail.com>
Seth Hoenig <seth.a.hoenig@gmail.com>
Seth Vargo <sethvargo@gmail.com>
Shahar Kohanim <skohanim@gmail.com>
Shamil Garatuev <garatuev@gmail.com>
Shane Hansen <shanemhansen@gmail.com>
Shaozhen Ding <dsz0111@gmail.com>
Shaun Dunning <shaun.dunning@uservoice.com>
Shawn Elliott <sellott@microsoft.com>
Shawn
Ledbetter <sledbetter@google.com>
Shawn Smith <shawn.p.smith@gmail.com>
Shawn Walker-Salas <shawn.walker@oracle.com>
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>
Shengjing Zhu <zs950618@gmail.com>
Shengyu Zhang <shengyu.zhang@chaitin.com>
Shi Han Ng <shihanng@gmail.com>
Shijie Hao <haormj@gmail.com>
Shinji Tanaka <shinji.tanaka@gmail.com>
Shintaro Kaneko <kaneshin0120@gmail.com>
Shivakumar GN <shivakumar.gn@gmail.com>
Shivani Singhal <shivani.singhal2804@gmail.com>
Shivansh Rai <shivansh@freebsd.org>
Shubham Sharma <shubham.sha12@gmail.com>
Shun Fan <sfan@google.com>
Silvan Jegen <s.jegen@gmail.com>
Simon Jefford <simon.jefford@gmail.com>
Simon Rawet <simon@rawet.se>
Simon Thulbourn <simon+github@thulbourn.com>
Simon Whitehead <chemnova@gmail.com>
Sina Siadat <siadat@gmail.com>

Sokolov Yura <funny.falcon@gmail.com>
Song Gao <song@gao.io>
Spencer Nelson <s@spenczar.com>
Spencer Tung <spencertung@google.com>
Spring Mc <heresy.mc@gmail.com>
Srdjan Petrovic <spetrovic@google.com>
Sridhar
Venkatakrisnan <sridhar@laddoo.net>
StalkR <stalkr@stalkr.net>
Stan Schwertly <stan@schwertly.com>
Stanislav Afanasev <php.progger@gmail.com>
Steeve Morin <steeve.morin@gmail.com>
Stefan Baebler <sbaebler@outbrain.com>
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>
Stepan Shabalin <neverliberty@gmail.com>
Stephan Renatus <srenatus@chef.io>
Stephan Zuercher <zuercher@gmail.com>
Stphane Travostino <stephane.travostino@gmail.com>
Stephen Lewis <stephen@sock.org.uk>
Stephen Lu <steuhs@users.noreply.github.com>
Stephen Ma <stephenm@golang.org>
Stephen McQuay <stephen@mcquay.me>
Stephen Searles <stephens2424@gmail.com>
Stephen Weinberg <stephen@q5comm.com>
Steve Francia <spf@golang.org>
Steve Gilbert <stevegilbert23@gmail.com>
Steve LoFurno <slofurno@gmail.com>
Steve McCoy <mccoyst@gmail.com>
Steve Mynott <steve.mynott@gmail.com>
Steve Newman <snewman@google.com>
Steve Phillips <elimistev@gmail.com>
Steve Streeting <steve@stevestreeting.com>
Steven Buss
<sbuss@google.com>
Steven Elliot Harris <seharris@gmail.com>
Steven Erenst <stevenerenst@gmail.com>
Steven Hartland <steven.hartland@multiplay.co.uk>
Steven Littiebrant <imgroxx@gmail.com>
Steven Wilkin <stevenwilkin@gmail.com>
Stuart Jansen <sjansen@buscaluz.org>
Sue Spence <virtuallysue@gmail.com>
Sugu Sougoumarane <ssougou@gmail.com>
Suharsh Sivakumar <suharshs@google.com>
Sukrit Handa <sukrit.handa@utoronto.ca>
Sunny <me@darkowlzz.space>
Suriyaa Sundararuban <suriyaasundararuban@gmail.com>
Suyash <dextrous93@gmail.com>
Suzy Mueller <suzmue@golang.org>

Sven Almgren <sven@tras.se>
Sven Blumenstein <svbl@google.com>
Sylvain Zimmer <sylvain@sylvainzimmer.com>
Syohei YOSHIDA <syohex@gmail.com>
Szabolcs Nagy <nsz@port70.net>
Taavi Kivisik <taavi.kivisik@gmail.com>
Tad Fisher <tadfisher@gmail.com>
Tad Glines <tad.glines@gmail.com>
Tadas Valiukas <tadovas@gmail.com>
Taesu Pyo <pyotaesu@gmail.com>
Tai Le <letientai299@gmail.com>
Taj Khattrra <taj.khattrra@gmail.com>
Takashi Matsuo <tmatsuo@google.com>
Takayoshi
Nishida <takayoshi.nishida@gmail.com>
Takeshi YAMANASHI <9.nashi@gmail.com>
Takuto Ikuta <tikuta@google.com>
Takuya Ueda <uedatakuya@gmail.com>
Tal Shprecher <tshprecher@gmail.com>
Tamir Duberstein <tamird@gmail.com>
Tao Shen <shentaoskyking@gmail.com>
Tao Wang <twang2218@gmail.com>
Tarmigan Casebolt <tarmigan@gmail.com>
Taro Aoki <aizu.s1230022@gmail.com>
Taru Karttunen <taruti@taruti.net>
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>
Tatsuya Kaneko <m.ddot.x.f@gmail.com>
Taufiq Rahman <taufiqrx8@gmail.com>
Teague Cole <tnc1443@gmail.com>
Ted Kornish <golang@tedkornish.com>
Tejasvi Nareddy <tejunareddy@gmail.com>
Terin Stock <terinjokes@gmail.com>
Terrel Shumway <gopher@shumway.us>
Tetsuo Kiso <tetsuokiso9@gmail.com>
Than McIntosh <thanm@google.com>
Thanabodee Charoenpiriyakij <wingyminus@gmail.com>
Thanatat Tamtan <acoshift@gmail.com>
Thiago Avelino <t@avelino.xxx>
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>
Thomas Alan Copeland <talan.copeland@gmail.com>
Thomas
Bonfort <thomas.bonfort@gmail.com>
Thomas Bouldin <inlined@google.com>
Thomas Bruyelle <thomas.bruyelle@gmail.com>
Thomas Bushnell, BSG <tbushnell@google.com>
Thomas de Zeeuw <thomasdezeeuw@gmail.com>
Thomas Desrosiers <thomasdesr@gmail.com>
Thomas Habets <habets@google.com>

Thomas Kappler <tkappler@gmail.com>
Thomas Meson <zllak@hycik.org>
Thomas Wanielista <tomwans@gmail.com>
Thorben Krueger <thorben.krueger@gmail.com>
Thordur Bjornsson <thorduri@secnorth.net>
Tiago Queiroz <contato@tiago.eti.br>
Tianon Gravi <admwiggin@gmail.com>
Tilman Dilo <tilman.dilo@gmail.com>
Tim Cooijmans <timcooijmans@gmail.com>
Tim Cooper <tim.cooper@layeh.com>
Tim Ebringer <tim.ebringer@gmail.com>
Tim Heckman <t@heckman.io>
Tim Henderson <tim.tadh@gmail.com>
Tim Hockin <thockin@google.com>
Tim Swast <swast@google.com>
Tim Wright <tenortim@gmail.com>
Tim Xu <xiaoxubeii@gmail.com>
Timo Savola <timo.savola@gmail.com>
Timo Truys <alkaloid.btx@gmail.com>
Timothy Studd <tim@timstudd.com>
Tipp
Moseley <tipp@google.com>
Tobias Assarsson <tobias.assarsson@gmail.com>
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>
Tobias Klauser <tklauser@distanz.ch>
Toby Burrell <kurin@google.com>
Todd Kulesza <tkulesza@google.com>
Todd Neal <todd@tneal.org>
Todd Wang <toddwang@gmail.com>
Tom Anthony <git@tomanthony.co.uk>
Tom Bergan <tombergan@google.com>
Tom Heng <zhm20070928@gmail.com>
Tom Lanyon <tomlanyon@google.com>
Tom Levy <tomlevy93@gmail.com>
Tom Limoncelli <tal@whatexit.org>
Tom Linfoord <tomlinfoord@gmail.com>
Tom Payne <twpayne@gmail.com>
Tom Szymanski <tgs@google.com>
Tom Thorogood <me+google@tomthorogood.co.uk>
Tom Wilkie <tom@weave.works>
Tommy Schaefer <tommy.schaefer@teecom.com>
Tomoya Ishizaki <zaq1tomo@gmail.com>
Tonis Tiigi <tonistiigi@gmail.com>
Tony Reix <tony.reix@bull.net>
Tony Walker <walkert.uk@gmail.com>
Tooru Takahashi <tooru.takahashi134@gmail.com>
Tor Andersson <tor.andersson@gmail.com>
Tormod Erevik Lea <tormodlea@gmail.com>

Toshihiro
Shiino <shiino.toshihiro@gmail.com>
Toshiki Shima <hayabusa1419@gmail.com>
Totoro W <tw19881113@gmail.com>
Travis Bischel <travis.bischel@gmail.com>
Travis Cline <travis.cline@gmail.com>
Trevor Strohman <trevor.strohman@gmail.com>
Trey Lawrence <lawrence.trey@gmail.com>
Trey Roessig <trey.roessig@gmail.com>
Trey Tacon <ttacon@gmail.com>
Tristan Amini <tamini01@ca.ibm.com>
Tristan Colgate <tcolgate@gmail.com>
Tristan Oohry <ooohry@gmail.com>
Tristan Rice <rice@fn.lc>
Troels Thomsen <troels@thomsen.io>
Trung Nguyen <trung.n.k@gmail.com>
Tudor Golubenco <tudor.g@gmail.com>
Tugdual Saunier <tugdual.saunier@gmail.com>
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>
Tyler Bui-Palsulich <tpalsulich@google.com>
Tyler Bunnell <tylerbunnell@gmail.com>
Tyler Treat <ttreat31@gmail.com>
Tzu-Jung Lee <roylee17@currant.com>
Udalov Max <re.udalov@gmail.com>
Ugorji Nwoke <ugorji@gmail.com>
Ulf Holm Nielsen <doktor@dyregod.dk>
Ulrich Kunitz <uli.kunitz@gmail.com>
Umang Parmar <umangiparmar@gmail.com>
Uriel
Mangado <uriel@berlinblue.org>
Urvil Patel <patelurvil38@gmail.com>
Uttam C Pawar <uttam.c.pawar@intel.com>
Vadim Grek <vadimprog@gmail.com>
Vadim Vygonets <unixdj@gmail.com>
Val Polouchkine <vpolouch@justin.tv>
Valentin Vidic <vvidic@valentin-vidic.from.hr>
Vega Garcia Luis Alfonso <vegacom@gmail.com>
Venil Noronha <veniln@vmware.com>
Veselkov Konstantin <kostozyb@gmail.com>
Viacheslav Poturaev <vearutop@gmail.com>
Victor Chudnovsky <vchudnov@google.com>
Victor Vrantchan <vrancean+github@gmail.com>
Vignesh Ramachandra <vickyramachandra@gmail.com>
Vikas Kedia <vikask@google.com>
Vincent Ambo <tazjin@googlemail.com>
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>
Vincent Vanackere <vincent.vanackere@gmail.com>
Vinu Rajashekhar <vinutheraj@gmail.com>

Vish Subramanian <vish@google.com>
Vishvananda Ishaya <vishvananda@gmail.com>
Visweswara R <r.visweswara@gmail.com>
Vitor De Mario <vitordemario@gmail.com>
Vivek Sekhar <vsekhar@google.com>
Vlad Krasnov <vlad@cloudflare.com>
Vladimir
Kovpak <cn007b@gmail.com>
Vladimir Kuzmin <vkuzmin@uber.com>
Vladimir Mihailenco <vladimir.webdev@gmail.com>
Vladimir Nikishenko <vova616@gmail.com>
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>
Vladimir Varankin <nek.narqo@gmail.com>
Volker Dobler <dr.volker.dobler@gmail.com>
Volodymyr Paprotski <vpaprots@ca.ibm.com>
W. Trevor King <wking@tremily.us>
Wade Simmons <wade@wades.im>
Wagner Riffel <wgriffel@gmail.com>
Walter Poupore <wpoupore@google.com>
Wander Lairson Costa <wcosta@mozilla.com>
Warren Fernandes <warren.f.fernandes@gmail.com>
Wayne Ashley Berry <wayneashleyberry@gmail.com>
Wedson Almeida Filho <wedsonaf@google.com>
Weerasak Chongnguluam <singpor@gmail.com>
Wi Cngru <crvv.mail@gmail.com>
Wei Fu <fhfuwei@163.com>
Wei Guangjing <vcc.163@gmail.com>
Wei Xiao <wei.xiao@arm.com>
Wei Xikai <xykwei@gmail.com>
Weichao Tang <tevic.tt@gmail.com>
Wembley G. Leach, Jr <wembley.gl@gmail.com>
Wenlei (Frank) He <wlhe@google.com>
Wenzel Lowe <lowewenzel@gmail.com>
Wil
Selwood <wselwood@gmail.com>
Wilfried Teiken <wteiken@google.com>
Will Beason <willbeason@gmail.com>
Will Chan <willchan@google.com>
Will Faught <will.faught@gmail.com>
Will Morrow <wmorrow.qdt@qualcommdatacenter.com>
Will Norris <willnorris@google.com>
Will Storey <will@summercat.com>
Willem van der Schyff <willemvds@gmail.com>
William Chan <willchan@chromium.org>
William Chang <mr.williamchang@gmail.com>
William Josephson <wjosephson@gmail.com>
William Orr <will@worrbase.com> <ay1244@gmail.com>
Wisdom Omuya <deafgoat@gmail.com>

Wu Yunzhou <yunzhouwu@gmail.com>
Xi Ruoyao <xry23333@gmail.com>
Xia Bin <snyh@snyh.org>
Xing Xing <mikespook@gmail.com>
Xu Fei <badgangkiller@gmail.com>
Xudong Zhang <felixmelon@gmail.com>
Xudong Zheng <7pkvm5aw@slicealias.com>
Xuyang Kang <xuyangkang@gmail.com>
Yamagishi Kazutoshi <ykzts@desire.sh>
Yan Zou <yzou@google.com>
Yang Tian <linuxty@gmail.com>
Yann Hodique <yhodique@google.com>
Yann Kerherv <yann.kerherv@gmail.com>
Yann Salan <yannsalaun1@gmail.com>
Yao
Zhang <lunaria21@gmail.com>
Yaron de Leeuw <jarondl@google.com>
Yasha Bubnov <girokompas@gmail.com>
Yasser Abdolmaleki <yasser@yasser.ca>
Yasuharu Goto <matope.ono@gmail.com>
Yasuhiro Matsumoto <mattn.jp@gmail.com>
Yasuyuki Oka <yasuyk@gmail.com>
Yazen Shunnar <yazen.shunnar@gmail.com>
Yestin Sun <ylh@pdx.edu>
Yesudeep Mangalapilly <yesudeep@google.com>
Yissakhar Z. Beck <yissakhar.beck@gmail.com>
Yo-An Lin <yoanlin93@gmail.com>
Yohei Takeda <yo.tak0812@gmail.com>
Yongjian Xu <i3dmaster@gmail.com>
Yorman Arias <cixtords@gmail.com>
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>
Yoshiyuki Mineo <yoshiyuki.mineo@gmail.com>
Yosuke Akatsuka <yosuke.akatsuka@gmail.com>
Yu Heng Zhang <annita.zhang@cn.ibm.com>
Yu Xuan Zhang <zyxsh@cn.ibm.com>
Yuji Yaginuma <yuuji.yaginuma@gmail.com>
Yuki OKUSHI <huyuumi.dev@gmail.com>
Yuki Yugui Sonoda <yugui@google.com>
Yukihiro Nishinaka <6elpinal@gmail.com>
Yury Smolsky <yury@smolsky.by>
Yusuke Kagiwada <block.rxckin.beats@gmail.com>
Yuusei
Kuwana <kuwana@kumama.org>
Yuval Pavel Zholkover <paulzhol@gmail.com>
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>
Zac Bergquist <zbergquist99@gmail.com>
Zach Bintliff <zintliff@gmail.com>
Zach Gershman <zachgersh@gmail.com>

Zach Jones <zachj1@gmail.com>
Zachary Amsden <zach@thundertoken.com>
Zachary Gershman <zgershman@pivotal.io>
Zak <zrjknill@gmail.com>
Zakatell Kanda <hi@zkanda.io>
Zellyn Hunter <zellyn@squareup.com> <zellyn@gmail.com>
Zev Goldstein <zev.goldstein@gmail.com>
Zheng Dayu <davidzheng23@gmail.com>
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Zhongtao Chen <chenzhongtao@126.com>
Zhongwei Yao <zhongwei.yao@arm.com>
Zhou Peng <p@ctruple.cn>
Ziad Hatahet <hatahet@gmail.com>
Zorion Arrizabalaga <zorionk@gmail.com>
<a.maksadbek@gmail.com>
<max.faceless.frei@gmail.com>
<hagen1778@gmail.com>
<tbunyk@gmail.com>
<faxriddinjon@gmail.com>
<zs349596@gmail.com>
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1.225 nginx 1.18.0

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1.226 pam 1.5.2

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a)

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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1.230 kubernetes-apimachinery 1.8.11

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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1.231 kubernetes-api 1.8.11

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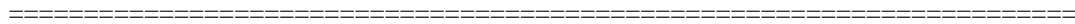
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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Gocheck - A rich testing framework for Go

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1.234 @tensorflow/tfjs-core 3.11.0

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}

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.js.map

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```
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```

```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusibleActivation } from\n './types';\n\nlet wasmFusedMatMul:\n (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha:
```

```

number, outId: number) =>\n    void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul =
backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n  'number', // a_id\n  'array', // a_shape\n  'number', //
a_shape.length\n  'number', // b_id\n  'array', // b_shape\n  'number', // b_shape.length\n  'number', //
transpose_a\n  'number', // transpose_b\n  'number', // activation\n  'number', // biasId\n  'number', //
preluActivationWeightsId\n  'number', // leakyreluAlpha\n  'number' // out_id\n  ]);\n\nfunction
fusedBatchMatMul(args: {\n  inputs: _FusedMatMulInputs,\n  backend: BackendWasm,\n  attrs:
_FusedMatMulAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const {a, b, bias, preluActivationWeights} =
inputs;\n\n  if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n    throw new Error(\n      ` _FusedMatMul for non
non-float32 tensors not yet supported.`);\n  }\n\n  const {transposeA, transposeB, activation, leakyreluAlpha}
= attrs;\n  const aId = backend.dataIdMap.get(a.dataId).id;\n  const bId = backend.dataIdMap.get(b.dataId).id;\n\n
let biasId = 0;\n  if (bias != null) {\n    const biasData = backend.dataIdMap.get(bias.dataId);\n    if
(biasData.shape.length !== 1) {\n      throw new Error(\n        ` _FusedMatMul only supports rank-1 bias but got `
+\n        `rank ${biasData.shape.length}.`);\n    }\n    biasId = biasData.id;\n  }\n  const preluActivationWeightsId =
preluActivationWeights == null ?\n    0 : \n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  const
fusedActivation = \n    FusableActivation[activation as { } as keyof typeof FusableActivation];\n  if
(fusedActivation == null) {\n    throw new Error(\n      `${activation} activation not yet supported for
FusedConv2D ` +\n      `in the wasm backend.`);\n  }\n\n  const leftDim = transposeA ? a.shape[2] : a.shape[1];\n
const rightDim = transposeB ? b.shape[1] : b.shape[2];\n  const batchDim = a.shape[0];\n\n  const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n
wasmFusedMatMul(\n    aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n    transposeA,
transposeB, fusedActivation, biasId, preluActivationWeightsId,\n    leakyreluAlpha || 0, outId);\n\n  return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n  kernelName: _FusedMatMul,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n"}

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/_FusedMatMul.js.map

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* =====
```



```
*/
/*! *****
```

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```
***** */
```

```
/**
```

- * @deprecated Use `setWasmPaths` instead.
 - * Sets the path to the `.wasm` file which will be fetched when the wasm backend is initialized. See
 - * <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>
 - * for more details.
 - * @param path wasm file path or url
 - * @param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.
 - *
 - * @doc {heading: 'Environment', namespace: 'wasm'}
- ```
*/
```

Found in path(s):

```
*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.js
```

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```
/**
```

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```

*/
/**
 * @deprecated Use `setWasmPaths` instead.
 * Sets the path to the `wasm` file which will be fetched when the wasm
 * backend is initialized. See
 * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
 * for more details.
 * @param path wasm file path or url
 * @param usePlatformFetch optional boolean to use platform fetch to download
 * the wasm file, default to false.
 *
 * @doc {heading: 'Environment', namespace: 'wasm'}
*/

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/backend_wasm.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/backend_wasm.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.js

```

No license file was found, but licenses were detected in source scan.

```

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License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====\n
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n"]}]

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```

No license file was found, but licenses were detected in source scan.

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=====

```
\n*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppDType} from
 './types';\nexport function createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig
{\n let wasmFunc: (xId: number, dtype: number, outId: number) => void;\n\n function setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', //
x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend:
BackendWasm, inputs: UnaryInputs}):
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, outType || x.dtype);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary\_kernel.js.map

No license file was found, but licenses were detected in source scan.

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=====
```

```
\n*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.js.map

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AC","sourcesContent":["/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
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License.\n
* =====\n
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n"]}
```

Found in path(s):

```
*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Tan.js.map
```

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```
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {identity} from './Identity';\nimport {CppType} from './types';\nlet wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n export function transpose(\n args: {\n inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs\n }): TensorInfo {\n const {inputs, backend, attrs} = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n if (permIsNoOp) {\n const cloned = identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n const out = backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n wasmTranspose(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return out;\n }\n function computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n }\n function removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n }\n }\n }\n }\n}
```

```
}
} newPerm[minValIdx] = i;
} return [newShape, newPerm];
} export const transposeConfig:
KernelConfig = {
 kernelName: Transpose,
 backendName: 'wasm',
 kernelFunc: transpose as {} as
 KernelFunc,
 setupFunc: setup,
};
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.js.map

No license file was found, but licenses were detected in source scan.

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=====
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-
core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { fill } from './Fill';\n\nimport { CppDType } from
 './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
 number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
 number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
 /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: { inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs }) {\n const
 { inputs: { x }, backend, attrs: { paddings, constantValue } } = args;\n\n const outShape = paddings.map(\n (p, i) =>
 p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape)
 === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute
 output shape to pad.\n return fill({\n backend,\n attrs: { shape: outShape, value: constantValue, dtype:
 x.dtype }\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
 backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
 outId = outTensorData.id;\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const
 prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple
 => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n const
 postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue,
 outId);\n\n return out;\n }\n\n export const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as KernelFunc,\n setupFunc: setup\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-  
wasm/dist/kernels/PadV2.js.map

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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/binary\_kernel.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.d.ts  
\*  
/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sigmoid.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GatherNd.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppressionV3.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedDepthwiseConv2D.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

wasm/src/kernels/NonMaxSuppressionV5.ts

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cos.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/AddN.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Log.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedConv2D.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.d.ts

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LeakyRelu.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthToSpace.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Tanh.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary\_kernel.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/index.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GreaterEqual.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Maximum.ts

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/SquaredDifference.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index\_test.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedBatchNorm.ts

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Less.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index\_test.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.d.ts  
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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Conv2D.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LessEqual.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary\_kernel.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherNd.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Tile.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.d.ts  
\*  
/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Relu6.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/types.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary\_kernel.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LeakyRelu.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SquaredDifference.d.ts  
\*  
/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Unpack.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ClipByValue.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RotateWithOffset.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FloorDiv.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LogicalAnd.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Slice.js

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cast.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu6.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Prelu.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ScatterNd.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/BatchMatMul.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MaxPool.js

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/CropAndResize.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sum.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FlipLeftRight.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthToSpace.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2D.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/DepthwiseConv2dNative.ts

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedBatchNorm.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RotateWithOffset.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/\_FusedMatMul.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/DepthToSpace.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Min.js  
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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cos.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/\_FusedMatMul.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MaxPool.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2D.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GatherV2.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.js  
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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppression\_util.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ResizeBilinear.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cast.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Multiply.ts  
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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Slice.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/PadV2.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Reshape.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/PadV2.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ArgMax.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthwiseConv2dNative.d.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Transpose.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Concat.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ExpandDims.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Maximum.js  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Rsqrt.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.d.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.js  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Abs.ts  
\*  
/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup\_test.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Slice.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedBatchNorm.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sin.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.js

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/kernels/AvgPool.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/DepthwiseConv2dNative.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cos.js
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Relu.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu6.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Pow.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/SquaredDifference.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Exp.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/NonMaxSuppression_util.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/NonMaxSuppression_util.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Square.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/ScatterNd.js
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/PadV2.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Sigmoid.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/LessEqual.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Maximum.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.js
No license file was found, but licenses were detected in source scan.

```

```

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qual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/MaxPool.ts","../src/kernels/Maximum.ts"
,"../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/MirrorPad.ts","../src/kernels/Minimum.ts","../src/kerne

```

```

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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n *
distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
null /* void */, [\n 'number',\n // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' //
out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:
BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { a, b, bias,
preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB,

```



```

activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n let biasId = 0;\n if (bias != null) {\n
const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new
Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
}\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n
FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw
new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n
}\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n
wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,
transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, CCppType[x.dtype], outId);\n return out;\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n
* limitations under the License.\n *
=====\n
*\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
../unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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```

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```
=====\n*\n\nimport { backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nexport function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?: DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId: number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: { backend: BackendWasm, inputs: BinaryInputs }):\n TensorInfo {\n const { backend, inputs } = args;\n const { a, b } = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32') {\n {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return { kernelName, backendName: 'wasm', setupFunc, kernelFunc };\n }\n\n "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
```

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```
=====\n*\n\nimport { Add, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from '../binary_kernel';\nconst supportsFullBroadcast = true;\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
```

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```
=====\n*\n\nimport { AddN, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nlet wasmFunc:\n (inputIds:
```

```

Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs,
 backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-
sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CppDType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed
to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
\n\n=====\n
*/\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n
 kernelFunc: identity as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from
'./Identity';\nimport {CppType}
from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
CppType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n
 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n
 'number', // perm.length\n]);\n}\n\nexport function transpose(\n args: {\n inputs: TransposeInputs, backend:
BackendWasm, attrs: TransposeAttrs):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n // Reduce any
dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n\n let permIsNoOp = true;\n for
(let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp
= false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId:
inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n};\n\n if (permIsNoOp) {\n const cloned =
identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =

```



or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(x: TensorInfo, axis: number|number[], backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if (permutedAxes !== null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({ inputs: { x }, attrs: { perm: permutedAxes }, backend});\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n return { transposed: xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n */
```

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```
=====\n*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: any as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
```

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```
* =====\n*\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmFunc: (\n xId: number, dtype: number, outerSize: number, innerSize: number,\n outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n function argmax(\n args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, inputWasTransposed } = permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n return out;\n }\n export const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n
```

```
 kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n };}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====*\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmAvgPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n function avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
```

```

const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
 throw new Error(\n `wasm backend does not support dataFormat:` +\n `${convInfo.dataFormat}'. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `wasm backend only supports average pooling with dilation = [1, 1],` +\n
 `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount
for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
kernelFunc: reshape as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport
{BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number' // out_id\n]);\n\n function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n
const

```

```

{transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n };\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n
util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions
must either be the ` +\n `same or at least one input batch dimension must be 1. Got input ` +\n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n
() => `Error in matMul: inner shapes (${innerShapeA}) and (+\n `${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n `${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n
[batchDimA, outerShapeA, innerShapeA];\n\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n
[batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation is
designed to operate on rank-3 tensors\n\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n
const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n\n const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n
backend.disposeData(b3d.dataId);\n\n out.shape = outShape;\n\n
return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName: BatchMatMul,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul as {} as KernelFunc\n};\n\n"/**\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport
{ assertNotComplex } from '../cpu_util';\n\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n const
isContinous = slice_util.isSliceContinous(shape, begin, size);\n const length = util.sizeFromShape(size);\n const
xStrides = util.computeStrides(shape);\n if (isContinous) {\n const flatOffset =
slice_util.computeFlatOffset(begin, xStrides);\n if (dtype === 'string') {\n return vals.slice(flatOffset,
flatOffset + length);\n }\n return vals.subarray(flatOffset, flatOffset + length);\n }\n const decodedData
= dtype === 'string' ?\n backend_util.fromUint8ToStringArray(vals) :\n vals;\n const inBuf =
buffer(shape, dtype, decodedData);\n const outBuf = buffer(size, dtype);\n for (let i = 0; i < outBuf.size; ++i) {\n
const outLoc = outBuf.indexToLoc(i);\n const inLoc = outLoc.map((idx, j) => idx + begin[j]);\n

```







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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { sliceImplCPU } from '../kernel_utils/shared';\nexport function slice(\n args: { inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm }) {\n const { inputs: { x }, attrs: { begin, size }, backend } = args;\n\n const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_, size_);\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));\n }\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2) {\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number, number, number, number], size_ as [number, number, number, number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride: number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals: backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals: backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const beginL = begin[3];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as {\n KernelFunc\n };,\n "/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
```

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```
=====
*/
import { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { reshape } from './Reshape';
import { slice } from './Slice';
import { transpose } from './Transpose';
function batchToSpaceND(args: { inputs: BatchToSpaceNDInputs, backend: BackendWasm, attrs: BatchToSpaceNDAttrs }) {
 const { inputs, backend, attrs } = args;
 const { x } = inputs;
 const { blockSize, crops } = attrs;
 const prod = blockSize.reduce((a, b) => a * b);
 const reshaped = backend_util.getReshaped(x.shape, blockSize, prod);
 const permuted = backend_util.getPermuted(reshaped.length, blockSize.length);
 const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockSize, prod);
 const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockSize.length);
 const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockSize.length);
 const xReshaped = reshape({ inputs: { x }, backend, attrs: { shape: reshaped } });
 const xTransposed = transpose({ inputs: { x: xReshaped }, backend, attrs: { perm: permuted } });
 const xTransposedReshaped = reshape({ inputs: { x: xTransposed }, backend, attrs: { shape: reshapedPermuted } });
 const result = slice({ inputs: { x: xTransposedReshaped }, backend, attrs: { begin: sliceBeginCoords, size: sliceSize } });
 backend.disposeData(xReshaped.dataId);
 backend.disposeData(xTransposed.dataId);
 backend.disposeData(xReshaped.dataId);
 return result;
}
export const batchToSpaceNDConfig: KernelConfig = {
 kernelName: BatchToSpaceND,
 backendName: 'wasm',
 kernelFunc: batchToSpaceND as KernelFunc
} as KernelFunc;
"/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 * implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
```

```
=====
*/
import { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';
import { TensorInfo } from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
export function cast(args: { inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm }): TensorInfo {
 const { inputs, attrs, backend } = args;
 const out = backend.makeOutput(x.shape, dtype);
 const inVals = backend.typeArrayFromHeap(x);
 const outVals = backend.typeArrayFromHeap(out);
 outVals.set(inVals);
 return out;
}
export const castConfig: KernelConfig = {
 kernelName: Cast,
 backendName: 'wasm',
 kernelFunc: cast as KernelFunc
} as KernelFunc;
"/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 * implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
```

```
=====
*/
import { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from
```







```

=====
*\n\nimport {backend_util,
Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId: number, batchSize:
number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,
padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n
dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels:
number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n
'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number',
// padLeft\n
 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n
'number', // outId\n]);\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:
Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n
 const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth, padTop,
padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth,
strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const
conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport
{backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,
KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,

```





```

wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number',
// cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number'
// out id\n]);\n\nfunction cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n
attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {method,
extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} = inputs;\n const numBoxes =
boxes.shape[0];\n\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape =
[numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData =
backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n
InterpolationMethod[method as {}] as keyof typeof InterpolationMethod),\n extrapolationValue, outId);\n\n if
(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from

```

```

./types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //
dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\n\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype
=== 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM
backend`);\n // permute required axis to inner most axis\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n
const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation
!== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out =
transpose(\n {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n }\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n]);\n}\n\nexport
function depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs:
DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const
{blockSize, dataFormat} = attrs;\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n const outputHeight = inputHeight *
blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize *
blockSize);\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth,
outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n const out =
backend.makeOutput(outputShape, 'float32');\n const xData = backend.dataIdMap.get(x.dataId);\n const xId =
xData.id;\n const xStridesBytes

```

```

 =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
 Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
 Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
 xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
 out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
 'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
 writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
 WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
 language governing permissions and\n * limitations under the License.\n */
 =====\n
 *\n\nimport { backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
 DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
 { BackendWasm } from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
 inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
 number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
 number, dilationWidth: number,
 strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n outId:
 number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
 batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
 filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
 padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n
 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
 inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction
 depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
 DepthwiseConv2dNativeAttrs\n}) {\n const { inputs, attrs, backend } = args;\n const { x, filter } =
 inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
 backend.dataIdMap.get(filter.dataId).id;\n\n const { strides, dilations, pad, dimRoundingMode } =
 attrs;\n\n const $dilations = dilations == null ? [1, 1] : dilations;\n\n const convInfo =
 backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad,
 dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const
 filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
 convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
 convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
 convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n
 const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const
 outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
 (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
 DepthwiseConv2dNative does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use
 'channelsLast'.`);\n }\n\n const out =
 backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
 padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight,
 strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const
 depthwiseConv2dNativeConfig:

```

```
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n", "/*\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright\n * 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input}\n = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as { } as KernelFunc,\n};\n", "/*\n *
```

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```
=====\n*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n\n\"/**\n *
```

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```
=====\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { }\n as KernelFunc,\n setupFunc: setup\n};\n\n\"/**\n *
```

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```
=====\n*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */, [\n 'number', 'number', 'number', 'number', 'number', 'number',\n 'number'];\n }\n}\n\nfunction fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs:
```



```

*/, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n
'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number',
// preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n);\n}\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n dataFormat,\n
dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {}] as keyof typeof
FusableActivation;\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet
supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n if
(biasData.shape[0] !== outputChannels)
{\n throw new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the
number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const
inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend
FusedConv2D does not support
dataFormat:` +\n ` ${dataFormat}. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet

```



```

wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n
filterId: number, filterHeight:
 number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n
padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number,
strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n
preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction
setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n
 backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number',
// dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias,
preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n const convInfo =
 backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n const fusedActivation =\n FusableActivation[activation
as {}] as keyof typeof FusableActivation;\n if (fusedActivation == null) {\n throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n
const outputChannels = convInfo.outChannels;\n let biasId = 0;\n if (bias != null) {\n const biasData =
 backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got` +\n `rank ${biasData.shape.length}.`);\n }\n
if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedDepthwiseConv2D bias shape` +\n `(${biasData.shape}) does not` +\n `match the number of output channels` +\n `(${outputChannels})`);\n }\n
biasId = biasData.id;\n }\n const filterHeight = convInfo.filterHeight;\n const
 filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
 strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n if
 (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support` +\n
 `dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n const out =
 backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
 preluActivationWeightsId = preluActivationWeights == null
 ?\n 0:\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n wasmFusedDepthwiseConv2d(\n
xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom,
padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels,
outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n return
 out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:
 FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as
 {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
 under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *

```

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```
=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';
*\n\nimport {BackendWasm} from './backend_wasm';
*\n\nimport {CppType} from './types';
*\n\nlet wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;
*\n\nfunction setup(backend: BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} = inputs;\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params, indices);\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return out;\n }\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};
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*/
=====
```

```
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';
*\n\nimport {BackendWasm} from './backend_wasm';
*\n\nimport {reshape} from './Reshape';
*\n\nimport {CppType} from './types';
*\n\nlet wasmGather: (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number, indicesId: number, batchSize: number, outStrides: Uint8Array, outId: number) => void;
*\n\nfunction setup(backend: BackendWasm): void {\n wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x, indices} = inputs;\n const {axis, batchDims} = attrs;\n // Throw error when any index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>`\n GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]\n `);\n }\n const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis, batchDims);\n const flattenX = reshape({\n inputs: [x],\n attrs: {\n shape: [\n shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: [x: indices],\n attrs:
```

```

{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n
 });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length
- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n
// reshape\n out.shape = shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig =
{\n kernelName: GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppDType} from
'./types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n]);\n}\n\nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm\n}): TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0)\n\n {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n
 }\n\n return out;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n
backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\n\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES

```

OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n *\\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const greaterEqualConfig: KernelConfig =\\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\n\\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from './backend_wasm';\\n\\nimport {permuteAxesAndTranspose} from './kernel_utils';\\nimport {CppType} from './types';\\n\\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) =>\\n void;\\n\\nfunction setup(backend: BackendWasm): void {\\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\\n 'number', // x_id\\n 'number', // dtype\\n 'number', // reduce_size\\n 'number', // out_id\\n]);\\n}\\n\\nfunction max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\\n TensorInfo {\\n const {backend, inputs, attrs} = args;\\n const {reductionIndices: axis, keepDims} = attrs;\\n const {x} = inputs;\\n const xId = backend.dataIdMap.get(x.dataId).id;\\n let inputId = xId;\\n let input = x;\\n \\n const {transposed, axes, originalAxes, inputWasTransposed} =\\n permuteAxesAndTranspose(x, axis, backend);\\n \\n if (inputWasTransposed) {\\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\\n input = transposed;\\n inputId = transposedId;\\n }\\n \\n const inputRank = input.shape.length;\\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\\n const [outShape, reduceShape] =\\n backend_util.computeOutAndReduceShapes(input.shape, axes);\\n const reduceSize = util.sizeFromShape(reduceShape);\\n \\n const out = backend.makeOutput(outShape, x.dtype);\\n \\n if (util.sizeFromShape(input.shape) !== 0) {\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\\n }\\n \\n if (inputWasTransposed) {\\n // dispose of the transposed tensor.\\n backend.disposeData(transposed.dataId);\\n }\\n \\n if (keepDims) {\\n // reshape\\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\\n out.shape = newShape;\\n }\\n \\n return out;\\n}\\n\\nexport const maxConfig: KernelConfig = {\\n kernelName: Max,\\n backendName: 'wasm',\\n setupFunc: setup,\\n kernelFunc: max as { } as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\\nimport {createBinaryKernelConfig} from './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const lessConfig: KernelConfig =\\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n * \\n *
```

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```
=====
*\n\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====
*\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====
*\n\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig =\n createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====
\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\n from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmMaxPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool = backend.wasm.cwrap(MaxPool, null / void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]
```

```

]);\n\nfunction maxPool(\n args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n\n // TF API supports int32 input. CPU and WebGL backend also support
int32\n // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n //\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n //\n // TODO: add
support for int32 input.\n util.assert(\n x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32
input is supported. Got ${x.dtype}.`);\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const
convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,
dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
 const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !==
'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat:` +\n
`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as {} as KernelFunc\n};\n\n"/**\n * @license\n
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport
{createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const
maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast}
from './Cast';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId

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!== xId) {\n //
transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n
inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n
cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n //
dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n //
reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n }\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return
out;\n}\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: mean as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND,
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n */
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {axis, keepDims} = attrs;\n const {x} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n
backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize,
outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: min as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file

```

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 software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
 OR CONDITIONS OF ANY KIND, either express or implied.\n \* See  
 the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode { \n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
 xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
 Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction
 setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-
 paddings\n 'array', // post-paddings\n 'number', //
 mode\n 'number', // outId\n]);\n}\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend:
 BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const { inputs: { x }, backend, attrs: { paddings, mode } } = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new
 Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const
 postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new
 Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new
 Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n xId, xShapeBytes, x.shape.length,
 CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
 MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
 kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc:
 setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *
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=====
*\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\n\nimport
 { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const
 minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\n"/**\n *
 @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain
 a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
 law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
 specific language governing permissions and\n * limitations under the License.\n *
 =====

```

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=====
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3,
 NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport
 { BackendWasm } from './backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet
 wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number,
 =====

```



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scoreThreshold: number) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n]);\n}\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs:
NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} =
inputs;\n\n const boxesId =
 backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n
// Since we are not using scores for V3, we have to delete it from the heap.\n
backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor
=\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
 pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`.\n */\n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:

```

```

number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices
= result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs =
result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n
return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[]
{\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as
{\n } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet
wasmFunc:\n (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number,
scoreThreshold: number, softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm):
void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n
 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', //

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iouThreshold\n 'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n\nfunction
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n
const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId,
scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const {pSelectedIndices,
selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are
not using validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize, 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as { } as KernelFunc,\n};\n",/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot,
null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', //
offValue\n 'number' // out_id\n]);\n\nfunction oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs,
backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth,
onValue, offValue} = attrs;\n\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const
indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return
out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as { } as KernelFunc,\n};\n",/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n",/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0
(the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
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the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.toArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n\n
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=====\n\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}) {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}};\n);\n }\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n util.assertShapesMatch(shape, t.shape, 'All tensors passed to stack must have matching shapes');\n util.assert(dtype === t.dtype, 'All tensors passed to stack must have matching dtypes');\n });\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT = expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n\n
```

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=====\n\n*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n}\n\nfunction pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation,\n\n
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since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n
backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n
wasmPadV2(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n
postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport const padV2Config: KernelConfig = {\n
kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
(input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n
}\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n
createBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n}\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x\n = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const\n {transposed,\n axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let\n reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,\n reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize\n = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize,\n\n CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return\n out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: prod as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *
\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express\n or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */\n\n=====\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,\n util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from\n './Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:\n number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =\n backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //\n oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //\n newWidth\n 'number',\n\n // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n}\n\nfunction resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const\n {backend, inputs, attrs} = args;\n\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size} =\n attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] =\n images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =
```







```
{KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\nimport\n\n{KernelConfig, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig}
from '/unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', // out_shape_length\n 'number' // out_id\n]);\n\n export function reverse(\n args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} = attrs;\n const axes = util.parseAxisParam(dims, x.shape);\n if (x.shape.length === 0) {\n return identity({inputs: {x}, backend});\n }\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length, outId);\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n backend.disposeData(out.dataId);\n return reshaped;\n }\n\n export const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc: setup\n }; \n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n */
```

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
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```
=====
*
import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';import {backend_util} from '@tensorflow/tfjs-core';import
{BackendWasm} from '../backend_wasm';let wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,
 numChannels: number, radians: number, centerX: number, centerY: number,
fillBytes: Uint8Array, fillLength: number, outId: number) => void;
function setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId
 'number', // batch
 'number', // imageHeight
 'number', // imageWidth
 'number', // numChannels
 'number', // radians
 'number', // centerX
 'number', // centerY
 'array', // fillBytes
 'number', // fillLength
 'number', // outId
]);
export function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,
 backend: BackendWasm,
 attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;
 const {image} = inputs;
 const {radians, fillValue, center} = attrs;
 const out = backend.makeOutput(image.shape, image.dtype);
 const imageId = backend.dataIdMap.get(image.dataId).id;
 const outId = backend.dataIdMap.get(out.dataId).id;
 const [batch, imageHeight, imageWidth, numChannels] = image.shape;
 const [centerX, centerY] =
 backend_util.getImageCenter(center, imageHeight, imageWidth);
 const fillIsBlack = fillValue === 0;
 const fullOpacityValue = 255;
 const fillValues = typeof fillValue === 'number' ? [fillValue, fillValue, fillValue,
 fillIsBlack ? 0 : fullOpacityValue] : [...fillValue, fullOpacityValue];
 const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);
 wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
 radians, centerX, centerY, fillBytes, fillValues.length, outId);
 return out;
}
export const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,
 backendName: 'wasm',
 kernelFunc: rotateWithOffset as {} as KernelFunc,
 setupFunc: setup\n};
/**
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 * WITHOUT WARRANTIES OR CONDITIONS
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 * and limitations under the License.
 */
=====
*
import {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';import {BackendWasm} from '../backend_wasm';import {CppType} from
 './types';let wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CCppType, sliceRank:
number,
 numUpdates: number, sliceSize: number, strides: Uint8Array,
 outputSize: number, outId: number)
=> void;
function setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
 null /* void */, [\n 'number', // indicesId
 'number', // updatesId
 'number', // dtype
 'number', // sliceRank
 'number', // numUpdates
 'number', // sliceSize
 'array', // strides
 'number', // outputSize
 'number', // outId
]);
function scatterNd(\n args: {\n backend:
BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} =
args;
 const {indices, updates} = inputs;
 const {shape} = attrs;
 const out = backend.makeOutput(shape,
 updates.dtype);
 if (util.sizeFromShape(shape) === 0) {\n return out;\n }
 const {sliceRank, numUpdates,
 sliceSize, strides, outputSize} =
 scatter_util.calculateShapes(updates, indices, shape);
 const indicesData =
 backend.dataIdMap.get(indices.dataId);
 const indicesId = indicesData.id;
 const updatesData =
 backend.dataIdMap.get(updates.dataId);
 const updatesId = updatesData.id;
 const stridesBytes = new
```

```

Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,\n stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as\n
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n
License.\n *

```

```

=====\n
*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport\n
{createUnaryKernelConfig} from './unary_kernel';\nexport const roundConfig: KernelConfig =\n
createUnaryKernelConfig(Round);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *\n
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n
compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n
 './unary_kernel';\nexport\n
const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n", "/*\n * @license\n * Copyright 2020\n
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\nimport\n
{BackendWasm} from './backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId:\n
 number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect\n
= backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n
 'number', // offset\n 'number', // outId\n]);\n\nfunction select(args: {inputs: SelectInputs, backend:\n
BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =\n
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =\n
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =\n
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =\n
t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n
util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport\n
const selectConfig:\n

```

```

 KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {} as KernelFunc,\n
 setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *

```

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```
=====
\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null / void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}): TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n wasmFunc(xId, outId);\n return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and limitations under the License.\n */\n*/\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} = args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape, logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n wasmFunc(xId, outId, channels, batch);\n return out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: 'Softmax',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and limitations under the License.\n */\n*/\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
```

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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {padV2Config} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<[number, number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX = padV2Config.kernelFunc({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n\n const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n const transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs: TransposeAttrs = {\n permutedReshapedPaddedPermutation\n }; \n const paddedXT =\n transpose({inputs: transposeInputs, backend, attrs: transposeAttrs});\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs: resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n return result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {\n inputs: SplitVInputs,\n attrs: SplitVAttrs,\n backend: BackendWasm\n }) {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
```

splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nlet wasmStep:\n(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\nfunction setup(backend:\nBackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\nfunction step(\n args: {\n backend:\n BackendWasm,\n inputs: StepInputs,\n attrs:\n StepAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { alpha } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape,\n x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype],\n outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: step as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions\n * and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n
```

```

*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n"/**\n * @license\n * Copyright
2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from
 './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number',
 // outShapeLength\n 'number', // outId\n]);\n}\n\nexport function stridedSlice(args: {\n backend:
BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {x} = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n
 ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n
 finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n
 } =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n
 backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const outputShapeBytes =\n new
Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
 new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n
 result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n backend.disposeData(out.dataId);\n
 }\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n"/**\n *
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```

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```
=====\n\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmSum: (xId:\n number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: { backend: BackendWasm, inputs:\n SumInputs, attrs: SumAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } =\n attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input =\n x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis,\n backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n // will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,\n input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,\n originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as { } as\n KernelFunc\n }; \n }\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n * \n */\n}
```

```
=====\n\n*\n\nimport { KernelConfig, Sub } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except\n * in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n * \n */
```

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs } from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmTile: (\n xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
```



```

number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number',
 // x_id\n 'array', // x_shape\n 'number', // x_shape.length\n 'array', // new_shape\n 'number', //
new_shape.length\n 'number' // out_id\n]);\n}\n\nfunction tile(\n args: {inputs: TileInputs, backend:
BackendWasm, attrs: TileAttrs}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const {reps} = attrs;\n const newShape: number[] = new
Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new
Uint8Array(new Int32Array(newShape).buffer);\n const out = backend.makeOutput(newShape, x.dtype);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length,
newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return out;\n}\n\nexport const tileConfig:
KernelConfig
= {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: tile as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
\n\n=====\n
*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const tanConfig: KernelConfig =
createUnaryKernelConfig(Tan);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
\n\n=====\n
*/\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n"/**\n * @license\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
\n\n=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK:
(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean, outValuesId:
number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK =
backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n

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'number', // outIndicesId\n]);\n\n\nexport const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n };\n\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: topk as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:
number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:
number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n const out = backend.makeOutput(outShape, image.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n return out;\n }\n\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *

```

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```
=====
*/nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
 '@tensorflow/tfjs-core';nimport {BackendWasm} from './backend_wasm';nimport {slice} from
 './Slice';nfunction unpack(n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):n
 TensorInfo[] {n const {inputs, backend, attrs} = args;n const {value} = inputs;n let {axis} = attrs;n if (axis <
 0) {n axis += value.shape.length;n }n const numOutputs = value.shape[axis];n const rank =
 value.shape.length;n const outShape: number[] = new Array(rank - 1);n let outIndex = 0;n for (let i = 0; i < rank;
 i++) {n if (i !== axis) {n outShape[outIndex++] = value.shape[i];n }n const outs: TensorInfo[] = new
 Array(numOutputs);n const begin = new Array(rank).fill(0);n const size = value.shape.slice();n size[axis] = 1;n
 for (let i = 0; i < outs.length; i++) {n begin[axis] = i;n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
 backend});n }n return outs.map(({dataId, dtype},
 shape: outShape));n}nexport const unpackConfig: KernelConfig = {n kernelName: Unpack,n backendName:
 'wasm',n kernelFunc: unpack as {} as KernelFunc,n};n/*n * @licensen * Copyright 2020 Google LLC. All
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 file except in compliance with the License.n * You may obtain a copy of the License atn *n *
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 OR CONDITIONS OF ANY KIND, either express or implied.n * See the License for the specific language
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=====
*/n//
```

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We explicitly import the modular kernels so they get registered in then// global registry when we compile
the library. A modular build would replacen// the contents of this file and import only the kernels that are
needed.nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';nimport {absConfig} from './kernels/Abs';nimport {addConfig} from
 './kernels/Add';nimport {addNConfig} from './kernels/AddN';nimport {allConfig} from './kernels/All';nimport
 {anyConfig} from './kernels/Any';nimport {argMaxConfig} from './kernels/ArgMax';nimport {avgPoolConfig}
from './kernels/AvgPool';nimport {batchMatMulConfig} from './kernels/BatchMatMul';nimport
 {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';nimport {castConfig} from './kernels/Cast';nimport
 {ceilConfig} from './kernels/Ceil';nimport {clipByValueConfig} from './kernels/ClipByValue';nimport
 {concatConfig} from './kernels/Concat';nimport {conv2DConfig} from './kernels/Conv2D';nimport
 {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';nimport
 {cosConfig} from './kernels/Cos';nimport {coshConfig} from './kernels/Cosh';nimport {cropAndResizeConfig}
from './kernels/CropAndResize';nimport {cumsumConfig} from './kernels/Cumsum';nimport
 {depthToSpaceConfig} from './kernels/DepthToSpace';nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';nimport {eluConfig} from './kernels/Elu';nimport {equalConfig} from
 './kernels/Equal';nimport {expConfig} from './kernels/Exp';nimport {expandDimsConfig} from
 './kernels/ExpandDims';nimport {fillConfig} from './kernels/Fill';nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';nimport {floorConfig} from './kernels/Floor';nimport {floorDivConfig} from
 './kernels/FloorDiv';nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';nimport
 {fusedConv2DConfig} from './kernels/FusedConv2D';nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';nimport {gatherNdConfig} from './kernels/GatherNd';nimport
 {gatherV2Config} from
```

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./kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport {greaterEqualConfig} from
./kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport {leakyReluConfig} from
./kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport {lessEqualConfig} from
./kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport {logicalAndConfig} from
./kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport {maximumConfig} from
./kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport {meanConfig} from
./kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
./kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport
{nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from
./kernels/NotEqual';\nimport {oneHotConfig} from './kernels/OneHot';\nimport {onesLikeConfig} from
./kernels/OnesLike';\nimport {packConfig} from './kernels/Pack';\nimport {padV2Config} from
./kernels/PadV2';\nimport {powConfig} from './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport
{prodConfig} from './kernels/Prod';\nimport {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from
./kernels/RealDiv';\nimport {reluConfig} from './kernels/Relu';\nimport {relu6Config} from
./kernels/Relu6';\nimport {reshapeConfig} from './kernels/Reshape';\nimport {resizeBilinearConfig} from
./kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport {rotateWithOffsetConfig}
from './kernels/RotateWithOffset';\nimport {roundConfig} from './kernels/Round';\nimport {rsqrtConfig} from
./kernels/Rsqrt';\nimport {scatterNdConfig} from './kernels/ScatterNd';\nimport
{selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {sinConfig}
from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from
./kernels/Softmax';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport {splitVConfig}
from './kernels/SplitV';\nimport {sqrtConfig} from './kernels/Sqrt';\nimport {squareConfig} from
./kernels/Square';\nimport {squaredDifferenceConfig} from './kernels/SquaredDifference';\nimport {stepConfig}
from './kernels/Step';\nimport {stridedSliceConfig} from './kernels/StridedSlice';\nimport {subConfig} from
./kernels/Sub';\nimport {sumConfig} from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport
{tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from './kernels/Tile';\nimport {topKConfig} from
./kernels/TopK';\nimport {transformConfig} from './kernels/Transform';\nimport {transposeConfig} from
./kernels/Transpose';\nimport
{unpackConfig} from './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all
kernel configs here\nconst kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n

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squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig];\n\nfor (const kernelConfig of kernelConfigs)
 {\n registerKernel(kernelConfig);\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend:
BackendWasm }) {\n
 const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { env } from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n])));\n\n**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n
 // Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(function(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}

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}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=("./this.program");var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"]}var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=
nodePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["in
spect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={ };console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof

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_scriptDir !== "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("\blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("\^")+1)}else{scriptDirectory=""}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("\fs");if(!nodePath)nodePath=require("\path");filename=n
odePath["normalize\"](filename);return
nodeFS["readFileSync\"](filename,binary?null:\utf8\)};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }if(ENVIRONMENT_IS_NODE){if(typeof
performance===\undefined\){global.performance=require("\perf_hooks\").performance} }var
out=Module["print\"]||console.log.bind(console);var err=Module["printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments\"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram\"];if(Module["quit\"])quit_=Module["quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown= ;if(!warnOnce.shown[text]){ warnOnce.shown[text]=1;er
r(text) } }var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary\"];var
noExitRuntime=Module["noExitRuntime\"]||true;if(typeof WebAssembly!=="object\"){ abort("\no
native wasm support detected\")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){ abort("Assertion failed: \"+text) } }function
getCFunc(ident){ var func=Module["_" +ident];assert(func,\Cannot call unknown function \"+ident+", make sure
it is exported");return func }function ccall(ident,returnType,argTypes,args,opts){ var
toC={\string\:function(str){ var ret=0;if(str!==null&&str!==undefined&&str!==0){ var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array\:function(arr){ var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret } };function
convertReturnValue(ret){ if(returnType===\string")return UTF8ToString(ret);if(returnType===\boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){ for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){ if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{ cArgs[i
]=args[i] } } }var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){ return type===\number" });var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){ return getCFunc(ident) }return
function(){ return ccall(ident,returnType,argTypes,arguments,opts) } }function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){ var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){ str+=String.fromCharCode(u0);continue } var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue } var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2} else{ u0=(u0&7)<<18|u1<<12|u2<<6|heap[idx

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x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAtAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors
()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]==="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof

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Module["postRun"]!==function)Module["postRun"]=[Module["postRun"];while(Module["postRun"].length){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)function addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a pthread worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDependencies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}if(dependenciesFulfilled){var callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module["preloadedAudios"]={};function abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.error("Pthread aborting at "+new Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the wasm failed"}}catch(err){abort(err)}}function getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at "+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}}else{if(readAsync){return new Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return getBinary(wasmBinaryFile)})}}function createWasm(){var info={"a":asmLibraryArg};function receiveInstance(instance,module){var exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-instantiate")}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}}function receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFile)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling

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back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))} else { return
instantiateArrayBuffer(receiveInstantiatedSource)} } if (Module["instantiateWasm"]) { try { var
exports=Module["instantiateWasm"](info, receiveInstance); return exports } catch (e) { err("Module.instantiateWasm
callback failed with error: "+e); return false } } instantiateAsync().catch(readyPromiseReject); return { } } var
ASM_CONSTS={10520:function(){throw"Canceled!"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback=="function"){callback(Module);continue}var func=callback.func;if(typeof
func=="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNQ:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADF:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw"Atomics.notify returned an unexpected value
"+ret}Module["_emscripten_futex_wake"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cancelThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.postMessage({"cmd":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cleanupThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in

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cleanupThread!";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb);initWorker:function(){,t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\\":\\"exit\\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\\":\\"cancelDone\\"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeThr
eadData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n(){delete
PThread.threads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}}),runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.threads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\\"processQueuedMainThread
Work\\"){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\\"spawnThread\\"){spawnThread(e.data)}else

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if(cmd===\"cleanupThread\"){cleanupThread(d[\"thread\"])}else
if(cmd===\"killThread\"){killThread(d[\"thread\"])}else
if(cmd===\"cancelThread\"){cancelThread(d[\"thread\"])}else
if(cmd===\"loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\"print\"){out(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else
if(cmd===\"printErr\"){err(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"alert\"){alert(\"Thread
\"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\"exitProcess\"){try{exit(d[\"returnCode\"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\":\":\"+e.lineno+\":
\"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\"message\",function(data){worker.onmessage({data:d
ata})});worker.on(\"error\",function(data){worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post
Message({\"cmd\": \"load\", \"urlOrBlob\": Module[\"mainScriptUrlOrBlob\"]|_scriptDir, \"wasmMemory\": wasmMe
mory, \"wasmModule\": wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length===0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId===mainThreadId){postMessag
e({\"cmd\": \"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\": \"processThreadQueu
e\"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\": \"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function

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_emsripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atomics.wait returned an unexpected value
\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emsripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr)}return
0}}function
_emsripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function
_emsripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emsripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListene
rs:function(){if(!JSEvents.removeAllEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene

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rs);JSEvents.removeEventListenersRegistered=true }},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){ var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return }}JSEvents.deferredCalls.push({ targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){ var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){ var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){ var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"\";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr

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ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:[],timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return

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ret},getSource:function(shader,count,string,length){var source="\n";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\nwebgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined||JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("\n
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\nlose_context")<0&&ext.inde
xOf("\ndebug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\n"){name=name.slice(0,name.lastIndexOf("\n"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GLctx.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\n"+j+"\n";loc=GLctx.getUniformLocation(p,n);id=GLctx.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=["\ndefault","\nlow-power","\nhigh-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\nfailIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var

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 canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emsripten_webgl_create_context(a0,a1){return _emsripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err}(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emsripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! spawnThread()
can only ever be called from main application thread!`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw`Internal
error!`;if(!threadParams.pthread_ptr)throw`Internal
error, no pthread ptr!`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthr
ead_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":"run","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthr
ead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer==="undefined"){err(`Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+

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8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[(threadInfoStruct>>2)+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd="\spawnThread";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw"Canceled!"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce("Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread")}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err("pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err("PThread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()===thread){err("Main
thread \"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err("pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
__pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
__sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case

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69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wri
te,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument

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s));var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["T"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["V"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var

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nts));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["o
a"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,argument
s)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,argume
nts)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).
apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["t
a"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa
"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["x
a"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da\
"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga"]]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha"]]).apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia"]]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja"]]).app
ly(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka"]]).apply(null,argum
ents)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La"]]).apply(null,a

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arguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["_a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"])=

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Module["asm"][["hb"]].apply(null,arguments);var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"]
["mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Modu
le["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fun
ction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]
=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_proc
ess_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_
id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emsc
ripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).app
ly(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(n
ull,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){retur
n(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"]
["tb"]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(
){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=
Module["asm"][["ub"]]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscrip
ten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]
["zb"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ab"]
]).apply(null,arguments)};var
_emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=function(){return(_emscripten_stack_set
limits=Module["_emscripten_stack_set_limits"]=Module["asm"][["Bb"]]).apply(null,arguments)};var

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nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\/g,\"/\"})arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"} }else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)} }if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print } }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!=\"0\"){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"} }read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return }onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else { var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){abort(\"no native wasm
support detected\")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort(\"Assertion failed: \"+text)} }function getCFunc(ident){var
func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \"+ident+\", make sure it is exported\");return
func }function ccall(ident,returnType,argTypes,args,opts){ var
toC={\"string\":function(str){var ret=0;if(str===null&&str===undefined&&str!=\"0\"){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\"array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i

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]=args[i] } } var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} } var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{ var
str="";while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{ var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} } }return str}function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else {if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63} }heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function

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addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
dependencies"]}(runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiverInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback==="function"){callback(Module);continue}var func=callback.func;if(typeof
func==="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function

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emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iocnt,pnum){var num=0;for(var
i=0;i<iocnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return
0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case
155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case
74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return
2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return
2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return
1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return
20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"])=Module[\"asm\"][\"k\"]}.apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"])=Module[\"asm\"][\"l\"]}.apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"])=Module[\"asm\"][\"m\"]}.apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"])=Module[\"asm\"][\"n\"]}.apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"])=M
odule[\"asm\"][\"o\"]}.apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"])=Module[\"
asm\"][\"p\"]}.apply(null,arguments)};var

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_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"][["q"]]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"][["s"]]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][["t"]]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["v"]]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["w"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,arguments)};var

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_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"P"]).
apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchN
orm"]=Module["asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Mod
ule["asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=M
odule["_FusedDepthwiseConv2D"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"T"]).apply(null
,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"U"
]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[_
"asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_
"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,argume
nts)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"
Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments
)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,argume
nts)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).
apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"c
a"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa
"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"g
a"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,argument
s)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][_"ka"]).apply(null,arguments)};var

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_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,arguments)};var

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_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["Ra"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]["Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["Ua"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]["Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["Wa"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]["Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ya"]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running..");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun(),1})else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required

```



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BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the  
License for the specific language governing permissions and limitations under the License.

```
=====
*\nimport './flags_wasm';\n\nimport { backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasmModule,
WasmFactoryConfig } from './wasm-out/tfjs-backend-wasm';\n\nimport { BackendWasmThreadedSimdModule } from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\n\nimport wasmFactoryThreadedSimd
from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n\n// @ts-ignore\nimport { wasmWorkerContents } from
'./wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\n\nimport wasmFactory from './wasm-out/tfjs-backend-
wasm.js';\n\ninterface TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype:
DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?:
Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-primitive.\n\nexport class
BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:
backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n\n return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes,
shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id,
size, memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n
(values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,
numBytes),\n memoryOffset);\n }\n\n async read(dataId: DataId):
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *
util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the
memory if the dataId has
0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force
Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if
(this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force
&& data.refCount > 0) {\n return false;\n }\n\n this.wasm._free(data.memoryOffset);\n\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return
refCount of a `TensorData`.\n */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n
const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId:
DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n
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this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable: false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n\nfunction createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n });\n\n\n\n /**\n * Returns the path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n }\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n }\n\n return wasmModuleFolder + path;\n }\n\n\n /**\n * Initializes the wasm module and creates the js <--> wasm bridge.\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\n export async function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) => {\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides the Emscripten module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n\n return prefix + path;\n });\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n // https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n if (customFetch) {\n factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix :\n ''));\n }\n\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten

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already called console.warn so no need to double log.\n return;\n }\n if (initAborted) {\n //
Emscripten calls `onAbort` twice, resulting in double error.\n // messages.\n return;\n }\n initAborted
= true;\n const rejectMsg =\n 'Make sure the server can serve the `.wasm` file relative to the '+\n
'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers';\n reject({message: rejectMsg});\n };\n\n let wasm:
Promise<BackendWasmModule>;\n // If `wasmPath` has been defined we must initialize the
 vanilla module.\n if (threadsSupported && simdSupported && wasmPath == null) {\n
factoryConfig.mainScriptUrlOrBlob = new Blob(\n [\n `var WasmBackendModuleThreadedSimd = `+\n
wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'});\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadsCount:
 module.cwrap('get_threads_count', 'number', []),\n registerTensor: module.cwrap(\n 'register_tensor',
null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n
]),\n disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n dispose:
 module.cwrap('dispose', voidReturnType, []),\n resolve({wasm: module});\n };\n\n function
typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype)
{\n case 'float32':\n return new Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n
 case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n
 }\n }\n\n const wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-
backend-wasm-threaded-simd.wasm'\n] as const;\n type
 WasmBinaryName = typeof wasmBinaryNames[number];\n\n let wasmPath: string = null;\n let wasmPathPrefix:
string = null;\n let wasmFileMap: {[key in WasmBinaryName]?: string} = {};\n let initAborted = false;\n let
customFetch = false;\n\n /**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file
which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n */\n /**\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
 */\n export function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
 'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' ' will be removed in a future release.);\n if
 (initAborted) {\n throw new Error(\n 'The
 WASM backend was already initialized. Make sure you call '+\n ' `setWasmPath()` before you call
 `tf.setBackend()` or `tf.ready()`');\n }\n wasmPath = path;\n customFetch = usePlatformFetch;\n }\n\n /**\n *
Configures the locations of the WASM binaries.\n */\n /**\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
 */\n export function setWasmPaths({\n 'tfjs-backend-wasm.wasm':
 'renamed.wasm',\n 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n 'tfjs-backend-wasm-threaded-
simd.wasm': 'renamed-threaded-simd.wasm'\n };\n /**\n * @param
 prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory where the WASM
binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled,
threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n * full paths
specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located in the same
directory, or
 * if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional boolean to use platform
fetch to download\n * the wasm file, default to false.\n */\n /**\n * @doc {heading: 'Environment', namespace:
'wasm'}\n */\n export function setWasmPaths(\n prefixOrFileMap: string|[key in WasmBinaryName]?: string),\n

```

```

usePlatformFetch = false): void {\n if (initAborted) {\n throw new Error(\n 'The WASM backend was already
initialized. Make sure you call '+\n `setWasmPaths()` before you call `tf.setBackend()` or '+\n
`tf.ready()`);\n }\n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else
{\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name =>
wasmFileMap[name] === null);\n if (missingPaths.length > 0) {\n throw new Error(\n `There were no
entries found for the following binaries: ` +\n `${missingPaths.join(',')}`. Please either call
setWasmPaths with a ` +\n `map providing a path for each binary, or with a string indicating ` +\n `the
directory where all the binaries can be found.`);\n }\n }\n customFetch = usePlatformFetch;\n}\n\n/** Used in
unit tests. */\nexport function resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n wasmFileMap =
{};\n customFetch = false;\n initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n * This must be called before calling
`tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads: number) {\n threadsCount =
numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * It is set after the
backend is initialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n
throw new Error(`WASM
backend not initialized.`);\n }\n return actualThreadsCount;\n}\n\n",export const wasmWorkerContents = 'var
Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(
`");console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join(
`");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["_instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["_wasmModule"],info);Module["_wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["_wasmModule"]=e.data.wa
smModule;Module["_wasmMemory"]=e.data.wasmMemory;Module["_buffer"]=Module["_wasmMemory"].buffer;
Module["_ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd==="objectTransfer"){Module["_PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd==="run"){Module["_performance_now_clock_drift"]=performance.now()-
e.data.time;Module["_emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["_establishStackSpace"](top,max);Module["_emscripten_tls_init"](
);Module["_PThread"].receiveObjectTransfer(e.data);Module["_PThread"].setThreadStatus(Module["_pthread_self
"](),1);try{var
result=Module["_invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["_getNoExitRuntime"]())Module[_
"PThread"].threadExit(result)}catch(ex){if(ex==="Canceled!"){Module["_PThread"].threadCancel()}else
if(ex!="unwind"){if(ex instanceof
Module["_ExitStatus"]){if(Module["_getNoExitRuntime"]()){}else{Module["_PThread"].threadExit(ex.status)}}el
se{Module["_PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]()){Module["_PThread"].threadCancel()}else
if(e.data.target==="setimmediate"){}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()}else{err(`worker.js received unknown command
`"+e.data.cmd);err(e.data)}}catch(ex){err(`worker.js onmessage() captured an uncaught exception:
`"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process==="object"&&typeof

```

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process.versions===\\"object\\"&&typeof process.versions.node===\\"string\\"){self={location:{href:___filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\\"worker_threads\\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\\"message\\",function(data){ onmessage({data:data})});var
nodeFS=require(\\"fs\\");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\\"utf8\\");}function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\\"undefined\\"){performance={now:function(){return Date.now()}}};"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\\"License\\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \\"AS IS\\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\\n
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n\n const {wasm} = await init();\n\n return new
BackendWasm(wasm);\n\n}, WASM_PRIORITY);\n\n"/** @license See the LICENSE file. *\n\n// This code is
auto-generated, do not modify this file!\n\nconst version = '3.11.0';\n\nexport
{version};\n\n}, "names":["CppType", "FusableActivation", "wasmFusedMatMul", "fusedMatMulConfig", "kernelNa
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```

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EMSGSIZE","EPROTONOSUPPORT","ESOCKTNOSUPPORT","EADDRNOTAVAIL","ENETRESET","EISCO  
NN","ENOTCONN","ETOOMANYREFS","EUSERS","EDQUOT","ESTALE","ENOTSUP","ENOMEDIUM","E  
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to\_main\_thread\_js","\_emsc  
ripten\_notify\_thread\_queue","targetThreadId","mainThreadId","\_abort","\_emsc  
ripten\_  
asm\_const\_int","code","sigPtr","argbuf","readAsmConstArgs","\_emsc  
ripten\_conditional\_set\_current\_thread\_status  
","expectedStatus","newStatus","\_emsc  
ripten\_futex\_wait","val","timeout","tNow","tEnd","exchange","wait","\_ems  
cripten\_memcpy\_big","dest","num","copyWithin","\_emsc  
ripten\_num\_logical\_cores","require\$\$\$4","cpus","navigato  
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ripten\_run\_in\_main\_runtime\_thread\_js","dateNow","\_e  
msc  
ripten\_receive\_on\_main\_thread\_js\_callArgs","readAsmConstArgsArray","double","\_emsc  
ripten\_receive\_on\_m  
ain\_thread\_js","proxiedFunctionTable","\_emsc  
ripten\_get\_heap\_size","emsc  
ripten\_realloc\_buffer","grow","\_emsc  
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Func","eventTypeId","eventData","userData","varargs","\_\_emsc  
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Found

in path(s):

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No license file was found, but licenses were detected in source scan.

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{"version":3,"file":"BatchToSpaceND.js","sourceRoot":"","sources":["../src/kernels/BatchToSpaceND.ts"],"names":[],"mappings":"AAAA;:::;;GAeG;AAEH,OAAO,EAAC,YAAY,EAAE,cAAc,EAAsE,MAAM,uBAAuB,CAAC;AAIxI,OAAO,EAAC,OAAO,EAAC,MAAM,WAAW,CAAC;AACIC,OAAO,EAAC,KAAK,EAAC,MAAM,SAAS,CAAC;AAC9B,OAAO,EAAC,SAAS,EAAC,MAAM,aAAa,CAAC;AAEtC,SAAS,cAAc,CAAC,IAIvB;IACC,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;IACnB,MAAM,EAAC,UAAU,EAAE,KAAK,EAAC,GAAG,KAAK,CAAC;IAEIC,MAAM,IAAI,GAAG,UAAU,CAAC,MAAM,CAAC,CAAC,CAAC,EAAE,CAAC,EAAE,EAAE,CAAC,CAAC,GAAG,CAAC,CAAC,CAAC;IAEhD,MAAM,QAAQ,GAAG,YAAY,CAAC,WAAW,CAAC,CAAC,CAAC,KAAK,EAAE,UAAU,EAAE,IAAI,CAAC,CAAC;IACrE,MAAM,QAAQ,GAAG,YAAY,CAAC,WAAW,CAAC,QAAQ,CAAC,MAAM,EAAE,UAAU,CAAC,MAAM,CAAC,CAAC;IAC9E,MAAM,gBAAgB,GACIB,YAAY,CAAC,mBAAMb,CAAC,CAAC,CAAC,KAAK,EAAE,UAAU,EAAE,IAAI,CAAC,CAAC;IACHe,MAAM,gBAAgB,GACIB,YAAY,CAAC,mBAAMb,CAAC,KAAK,EAAE,UAAU,CAAC,MAAM,CAAC,CAAC;IAC/D,MAAM,SAAS,GACX,YAAY,CAAC,YAAY,CAAC,gBAAgB,EAAE,KAAK,EAAE,UAAU,CAAC,MAAM,CAAC,CAAC;IAE1E,MA
```

AM,SAAS,GAAG,OAAO,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,QAAQ,EAAC,EAAC,CAAC,CAAC;IAC5E,MAAM,WAAW,GACb,SAAS,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,SAAS,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,IAAI,EAAE,QAAQ,EAAC,EAAC,CAAC,CAAC;IAC1E,MAAM,mBAAmB,GAAG,OAAO,CAC/B,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,WAAW,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,gBAAgB,EAAC,EAAC,CAAC,CAAC;IAC3E,MAAM,MAAM,GAAG,KAAK,CAAC;QACnB,MAAM,EAAE,EAAC,CAAC,EAAE,mBAAmB,EAAC;QAChC,OAAO;QACP,KAAK,EAAE,EAAC,KAAK,EAAE,gBAAgB,EAAE,IAAI,EAAE,SAAS,EAAC;KACID,CAAC,CAAC;IAEH,OAAO,CAAC,WAAW,CAAC,SAAS,CAAC,MAAM,CAAC,CAAC;IACtC,OAAO,CAAC,WAAW,CAAC,WAAW,CAAC,MAAM,CAAC,CAAC;IACxC,OAAO,CAAC,WAAW,CAAC,SAAS,CAAC,MAAM,CAAC,CAAC;IAEtC,OAAO,MAAM,CAAC;AACHb,CAAC;AAED,MAAM,CAAC,MAAM,oBAIoB,GAAiB;IACHd,UAAU,EAAE,cAAc;IAC1B,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,cAAkC;CAC/C,CAAC", "sourcesContent": ["/\*\*\n

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```
=====\n*\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from './Transpose';\n\nfunction batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs: BatchToSpaceNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape, crops } = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({ inputs: { x }, backend, attrs: { shape: reshaped } });\n const xTransposed = transpose({ inputs: { x: xReshaped }, backend, attrs: { perm: permuted } });\n const xTransposedReshaped = reshape({ inputs: { x: xTransposed }, backend, attrs: { shape: reshapedPermuted } });\n const result = slice({ inputs: { x: xTransposedReshaped }, backend, attrs: { begin: sliceBeginCoords, size: sliceSize } });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as KernelFunc\n};\n\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchToSpaceND.js.map

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```

ernels/ArgMax.ts", "../src/kernels/AvgPool.ts", "../src/kernels/Reshape.ts", "../src/kernels/BatchMatMul.ts", "../node\_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat\_impl.js", "../node\_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range\_impl.js", "../node\_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js", "../src/kernels/Slice.ts", "../src/kernels/BatchToSpaceND.ts", "../src/kernels/Cast.ts", "../src/kernels/Ceil.ts", "../src/kernels/ClipByValue.ts", "../src/kernels/Concat.ts", "../src/kernels/Conv2D.ts", "../src/kernels/Conv2DBackpropInput.ts", "../src/kernels/Cos.ts", "../src/kernels/Cosh.ts", "../src/kernels/CropAndResize.ts", "../src/kernels/Cumsum.ts", "../src/kernels/DepthToSpace.ts", "../src/kernels/DepthwiseConv2dNative.ts", "../src/kernels/Elu.ts", "../src/kernels/Equal.ts", "../src/kernels/Exp.ts", "../src/kernels/ExpandDims.ts", "../src/kernels/Fill.ts", "../src/kernels/FlipLeftRight.ts", "../src/kernels/Floor.ts", "../src/kernels/FloorDiv.ts", "../src/kernels/FusedBatchNorm.ts", "../src/kernels/FusedConv2D.ts", "../src/kernels/FusedDepthwiseConv2D.ts", "../src/kernels/GatherNd.ts", "../src/kernels/GatherV2.ts", "../src/kernels/Greater.ts", "../src/kernels/GreaterEqual.ts", "../src/kernels/LeakyRelu.ts", "../src/kernels/Less.ts", "../src/kernels/LessEqual.ts", "../src/kernels/Log.ts", "../src/kernels/LogicalAnd.ts", "../src/kernels/Max.ts", "../src/kernels/Maximum.ts", "../src/kernels/MaxPool.ts", "../src/kernels/Mean.ts", "../src/kernels/Min.ts", "../src/kernels/Minimum.ts", "../src/kernels/MirrorPad.ts", "../src/kernels/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression\_util.ts", "../src/kernels/NonMaxSuppressionV3.ts", "../src/kernels/NonMaxSuppressionV4.ts", "../src/kernels/NonMaxSuppressionV5.ts", "../src/kernels/NotEqual.ts", "../src/kernels/OneHot.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kernels/PadV2.ts", "../src/kernels/Pow.ts", "../src/kernels/Prelu.ts", "../src/kernels/Prod.ts", "../src/kernels/Range.ts", "../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kernels/ResizeBilinear.ts", "../src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/Round.ts", "../src/kernels/Rsqrt.ts", "../src/kernels/ScatterNd.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Sin.ts", "../src/kernels/Softmax.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Sqrt.ts", "../src/kernels/Square.ts", "../src/kernels/SquaredDifference.ts", "../src/kernels/Step.ts", "../src/kernels/StridedSlice.ts", "../src/kernels/Sub.ts", "../src/kernels/Sum.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kernels/Tile.ts", "../src/kernels/TopK.ts", "../src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/kernels/ZerosLike.ts", "../src/register\_all\_kernels.ts", "../src/flags\_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js", "../wasm-out/tfjs-backend-

wasm.js", "../src/backend\_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": [/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES

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=====\n \*\n \* This enum must align with the enum defined in cc/backend.h.\n \* export enum CppDType { float32 = 0,\n \* int32 = 1,\n \* bool = 2,\n \* string = 3,\n \* complex64 = 4\n \* }\n \* Must match enum in cc/fusable\_activations.h.\n \* export enum FusableActivation { linear = 0,\n \* relu = 1,\n \* relu6 = 2,\n \* prelu = 3,\n \* leakyrelu = 4,\n \* sigmoid = 5,\n \* elu = 6\n \* }\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed

under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n \*\n \* import { \_FusedMatMul, \_FusedMatMulAttrs, \_FusedMatMulInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n \* import { BackendWasm } from '../backend\_wasm';\n \* import { FusableActivation } from

```

./types';\n\nlet wasmFusedMatMul:\n (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number',\n // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' //\n out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:\n BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {a, b, bias,\n preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n `_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB,\n activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =\n backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n const\n biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `_FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}`);\n }\n biasId =\n biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0:\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw\n new Error(\n `_${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :\n b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],\n a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n }\n\n export const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n };
}

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}

=====
/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport\n {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} from './types';\n\nexport function\n createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:\n number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null / void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\n TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)\n === 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return\n {\n kernelName, backendName: 'wasm', setupFunc, kernelFunc\n };
}

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```

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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nexport\nfunction createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:\n DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*\n void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): \n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType =\n dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,\n b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new\n Int32Array(b.shape).buffer);\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,\n a.shape.length, bId, bShapeBytes, b.shape.length,\n CCppType[a.dtype], outId);\n\n // Currently only some\n float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32')\n {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,\n newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const\n loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =\n bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(`Broadcasting along outer dims is not yet\n `+\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return {kernelName, backendName: 'wasm', setupFunc,\n kernelFunc};\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
```

```

*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs,
backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-
sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n"/**\n
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc:
identity as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
'./Identity';\n\nimport {CppType}

```





```

}\n }\n\n return {transposed: xTransposed,
originalAxes, axes, inputWasTransposed};\n}\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet
wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:
{backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const
inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n
const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n
if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
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the License.\n *
=====
*\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n const [outShape, reduceShape] =\n

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backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n
 }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const anyConfig: KernelConfig = {\n
kernelName: Any,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: any as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====\n
*/\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'/kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n const {backend, inputs, attrs} = args;\n
const {axis} = attrs as {} as ArgMaxAttrs;\n const {x} = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId
 = xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n permuteAxesAndTranspose(x,
axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n
 }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
 }\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n kernelFunc:
 argmax as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====\n
*/\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number,\n
 batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number,\n
padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n

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strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n\n
const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
throw new Error(\n `wasm backend does not support dataFormat: ` +\n ` ${convInfo.dataFormat}'. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1], ` +\n
`got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *\n
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount for
the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
kernelFunc: reshape as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====
*/\n\nimport

```

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{BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number' // out_id\n]);\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n
const {transposeA,
transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n
aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions
must either be the `+\n `same or at least one input batch dimension must be 1. Got input `+\n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n
() => `Error in matMul: inner shapes (${innerShapeA}) and `+\n `-${innerShapeB}) of Tensors with shapes
${a.shape} and `+\n `-${b.shape} and transposeA=${transposeA}`+\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n
[batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n
[batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation is designed
to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n const
b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n
backend.disposeData(b3d.dataId);\n\n out.shape = outShape;\n
return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName: BatchMatMul,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul as {} as KernelFunc\n};\n\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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```













1dGlsLmFzc2VydfBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYWw  
NrZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUtlcG  
wodmFscywGJlZ2luLCAkc2l6ZSweC5zaGFwZSweC5kdHlwZSk7XG4gIHJldHVybiBiYWwNrZW5kLm1ha2  
VUZW5zb3JlZmZvKCRzaXplLCB4LmR0eXBILCBvdXRWYWxzKTtcbn1cblxuZXhw3J0IGNvbnN0IHNSaWN  
lQ29uZmlnOiBLZXJuZWxDb25maWcgPSB7XG4gIGtlcm5lbE5hbWU6IFNsaWNILFxuICBiYWwNrZW5kTmFtZ  
TogJ2NwdScsXG4gIGtlcm5lbEZ1bmM6IHNSaWNlIGFzIHt9IGFzIEdtcm5lbEZ1bmNcbn07XG4iXX0=","/\*\n  
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language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {sliceImplCPU} from
 './kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinous = slice_util.isSliceContinous(x.shape, begin_,
size_);\n\n const xVals = backend.readSync(x.dataId);\n\n const out = backend.makeOutput(size_, x.dtype);\n\n const
xStrides = util.computeStrides(x.shape);\n\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype ===
'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n);\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n\n outData.stringBytes = res as Uint8Array[];\n\n return
out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n\n const rank = x.shape.length;\n\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as
[number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as
TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number,
number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n begin_ as [number, number, number, number],\n size_ as [number, number, number,
number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n\n outVals.set(res);\n }\n\n return out;\n }\n\n function slice2d(\n xVals: backend_util.TypedArray, xStride:
number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i =
beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset +
size[1]), outOffset);\n outOffset += size[1];\n }\n }\n\n function
slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:
backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <
endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n }\n\n function slice4d(\n xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:
backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number,
number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK =
```

```

begin[2];\n const
 endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL =
begin[3];\n\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k <
endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n
outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc:
slice as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed
under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*/\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport
{ reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted
= backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n
attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig
= {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\n\nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport
{ TensorInfo } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from '../backend_wasm';\n\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs,
backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out =
backend.makeOutput(x.shape, dtype);\n const inVals = backend.typeArrayFromHeap(x);\n const outVals =
backend.typeArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const castConfig:
KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as {} as

```

KernelFunc,\n};\n", "/\*\n \* @license\n \* Copyright 2021 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n

\* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n function clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip\n } as KernelFunc;\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport\n {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {concatImplCPU} from './kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\nexport function concat(\n args: {\n inputs: ConcatInputs,\n backend: BackendWasm,\n attrs: ConcatAttrs\n }) {\n const {inputs, backend} = args;\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n const out = backend.makeOutput(outShape, inputs[0].dtype);\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n const shapes = $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n if ($inputs[0].dtype === 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional
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tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis
to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these
two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to
have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along
axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const
simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape
=\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n
const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n
const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b *
sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset =
b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals,
outOffset);\n outOffset += innerDim;\n }\n }\n return out;\n }\n\nexport const concatConfig: KernelConfig =
{\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as { } as KernelFunc,\n};\n\n"/**\n *
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law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,
inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null
/* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n

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const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please use
'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the
License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number, xChannelStride:
number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmConv2DBackpropInput =
backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n 'number', // filterId\n 'number', //
batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', //
inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', //
outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', //
leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number',
// xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n 'number',
// yRowStride\n 'number', // yColStride\n 'number',
// yChannelStride\n 'number', // outId\n]);\n}\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =

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convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n
const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight,
filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n
topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride,
yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n"/**\n * @license\n *
Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {cast}
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest
= 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:

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number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number',
// cropHeight\n 'number', // cropWidth\n 'number', // method\n
'number', // extrapolation value\n 'number' // out id\n]);\n\nfunction cropAndResize(args: {\n backend:
BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} =
inputs;\n\n const numBoxes = boxes.shape[0];\n\n const [cropHeight, cropWidth] = cropSize as [number,
number];\n\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData =
backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imagesShapeBytes = new Uint8Array(new
Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes,
imagesShapeBytes, cropHeight,\n cropWidth,\n InterpolationMethod[method as {}] as keyof typeof
InterpolationMethod],\n extrapolationValue, outId);\n\n if (castedData !== null) {\n
backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const cropAndResizeConfig:
KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
cropAndResize as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
 './types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n
'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number',
// out_id\n 'number' // dtype\n]);\n\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend:
BackendWasm, attrs: CumsumAttrs});\n\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} =
inputs;\n\n const {axis, exclusive, reverse} = attrs;\n\n const xRank = x.shape.length;\n\n util.assert(x.dtype ===
'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n //
permute required axis to inner most axis\n\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n\n
let permutedX = x;\n\n if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm:
permutation}, backend});\n }\n\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n\n const finalDim = permutedX.shape[permutedAxis];\n\n
const permutedXId
= backend.dataIdMap.get(permutedX.dataId).id;\n\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =

```



```

permutatedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutatedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutatedX.dataId);\n
backend.disposeData(permutatedOut.dataId);\n } \n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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 * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace
= backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number',
// channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', // outputShape\n 'array', //
outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n}\n\nexport function depthToSpace(args: {\n
backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize
= x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth =
(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
: x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n
const outputDepth = inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,
'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n
 setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet

```



```

=====
*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs:
ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} =
args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape
= input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n
util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n
inputRank}]);\n $dim = inputRank + dim + 1;\n } \n newShape.splice($dim, 0, 1);\n\n return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n
kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain
a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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```

=====
*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value,
dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals =
backendtypedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig:
KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

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implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*/\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {\n kernelFunc,\n setupFunc: setup\n };,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number'];\n);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
```

```
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n
const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
```

```
=====\n
*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,
padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,
dilationHeight: number,\n dilationWidth: number,
strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation:
number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number',
// strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n
'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n
'number', // outId\n]);\n}\n\nfunction fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend:
BackendWasm,\n attrs: FusedConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias,
preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as { } as keyof typeof
FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet
supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if
(biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got `
+\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new
Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output
channels (${outputChannels}).`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
```

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convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n
const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n
const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth =
convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D
does not support dataFormat:` +\n ` ${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n
return out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName: FusedConv2D,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as KernelFunc\n};\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n
filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction fusedDepthwiseConv2d(args: {\n
inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n
const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n
dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation as {}
as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation}

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activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
 }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias
shape (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n }\n
 biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new
Error(\n `wasm backend FusedDepthwiseConv2D does not support dataFormat:` +\n `${dataFormat}`.
Please use 'NHWC'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0
:\n backend.dataIdMap.get(reluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId,
batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CCppType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n
'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,
inputs: GatherNdInputs}): \n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n
 const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CCppType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig:
KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:

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gatherNd\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR

CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { reshape } from './Reshape';\nimport { CppDType } from './types';\n\nlet wasmGather:\n (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize: number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number' // outId\n]);\n\n function gatherV2(\n args: { backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { x, indices } = inputs;\n const { axis, batchDims } = attrs;\n // Throw error when any index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId as TypedArray);\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>`\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis, batchDims);\n const flattenX = reshape({\n inputs: { x },\n attrs: {\n shape: [\n shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n],\n backend\n });\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: { x: indices },\n attrs: { shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize] },\n backend\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length - 1;\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n const indicesData = backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const xStridesBytes = new Uint8Array(\n new Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n wasmGather(\n xId, CppDType[x.dtype], xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n // reshape\n out.shape = shapeInfo.outputShape;\n return out;\n }\n\n export const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n };\n};\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed
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under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====\n\n
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*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed
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under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
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*\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
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\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null / void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }):\n TensorInfo {\n const {inputs: [x], attrs: {alpha}, backend} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppType[x.dtype], alpha, outId);\n }\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n };\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
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*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
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language governing permissions and\n \* limitations under the License.\n \*

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=====\n\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\n\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n"/**\n\n * @license\n\n * Copyright 2019\n\n * Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless required by applicable\n\n * law or agreed to in writing, software\n\n * distributed under the License is distributed on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under the License.\n\n */
```

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=====\n\n*\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n"/**\n\n * @license\n\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the\n\n * "License");\n\n * you may not use this file except in compliance with the License.\n\n * You may obtain a copy of the\n\n * License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless required by applicable law or\n\n * agreed to in writing, software\n\n * distributed under the License is distributed\n\n * on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n\n * implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under the\n\n * License.\n\n */
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=====\n\n*\n\nimport { KernelConfig, LogicalAnd } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig =\n\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n"/**\n\n * @license\n\n * Copyright 2019\n\n * Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless required by applicable law or agreed to in writing,\n\n * software\n\n * distributed under the License is\n\n * distributed on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n\n * express or implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under\n\n * the License.\n\n */
```

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=====\n\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n\n 'number', // x_id\n\n 'number', // dtype\n\n 'number', // reduce_size\n\n 'number', // out_id\n\n]);\n\n function max(args: { backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }): TensorInfo {\n\n const { backend, inputs, attrs } = args;\n\n const { reductionIndices: axis, keepDims } = attrs;\n\n const x = inputs;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n let inputId = xId;\n\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n\n input = transposed;\n\n inputId = transposedId;\n\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n\n const [outShape, reduceShape] =\n\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n const reduceSize =\n\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if
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(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n };\n\n if (inputWasTransposed) {\n
 // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n };\n\n if (keepDims) {\n //
reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n };\n\n return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing
permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====
*/\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number',
// padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number',
// inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // TF API
supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it
because it uses xnnpack which only\n // supports float32.\n //\n // Add the following assert only for the WASM
backend instead of at core op\n // level.\n //\n // TODO: add support for int32 input.\n util.assert(\n x.dtype
=== 'float32',\n () =>\n `Error in MaxPool: only float32 input
is supported. Got ${x.dtype}.`);\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =

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convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm
backend does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n
const out = backend.makeOutput(convInfo.outShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmMaxPool(\n xId, x.shape[0],
x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight,
dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport
const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: maxPool as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs};\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n
cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n
inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape,
'float32');\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:
KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {}
as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\\n
*\\n\\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from './backend_wasm';\\n\\nimport
{permuteAxesAndTranspose} from './kernel_utils';\\nimport { CppDType } from './types';\\n\\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\\n void;\\n\\nfunction setup(backend:
BackendWasm): void {\\n wasmMin = backend.wasm.cwrap(Min,
 null /*void*/, [\\n 'number', // x_id\\n 'number', // dtype\\n 'number', // reduce_size\\n 'number', // out_id\\n
]);\\n}\\n\\nfunction min(args: { backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\\n TensorInfo {\\n
 const { backend, inputs, attrs } = args;\\n const { axis, keepDims } = attrs;\\n const { x } = inputs;\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n let inputId = xId;\\n let input = x;\\n\\n const { transposed, axes, originalAxes,
inputWasTransposed } =\\n permuteAxesAndTranspose(x, axis, backend);\\n\\n if (inputWasTransposed) {\\n
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;\\n if (transposedId !== xId) {\\n // transpose
was not a no-op. We will need to dispose of this\\n // once we are done.\\n input = transposed;\\n inputId =
transposedId;\\n }\\n}\\n const inputRank = input.shape.length;\\n\\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\\n const [outShape, reduceShape] =\\n
 backend_util.computeOutAndReduceShapes(input.shape,
 axes);\\n const reduceSize = util.sizeFromShape(reduceShape);\\n\\n const out = backend.makeOutput(outShape,
input.dtype);\\n if (util.sizeFromShape(input.shape) !== 0) {\\n const outId =
backend.dataIdMap.get(out.dataId).id;\\n wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\\n }\\n\\n if
(inputWasTransposed) {\\n // dispose of the transposed tensor.\\n backend.disposeData(transposed.dataId);\\n
}\\n\\n if (keepDims) {\\n // reshape\\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\\n out.shape = newShape;\\n }\\n}\\n return out;\\n}\\n}\\n\\nexport const minConfig: KernelConfig = {\\n
 kernelName: Min,\\n backendName: 'wasm',\\n setupFunc: setup,\\n kernelFunc: min as {} as
KernelFunc\\n};\\n", /*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
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"AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License
for the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from
'./binary_kernel';\\nconst supportsFullBroadcast = false;\\nexport const minimumConfig: KernelConfig =\\n
createBinaryKernelConfig(Minimum, supportsFullBroadcast);\\n", /*\\n * @license\\n * Copyright 2021 Google
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by applicable law or agreed to in writing, software\\n * distributed under the License is distributed on an "AS IS"
BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License
for the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\\n\\nimport { BackendWasm } from './backend_wasm';\\n\\nimport { CppDType } from './types';\\n\\n// Must match
enum in MirrorPad.cc\\nenum MirrorPaddingMode {\\n reflect = 0,\\n symmetric = 1\\n}\\n\\nlet wasmMirrorPad: (\\n
 xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\\n prePaddingsBytes:
 Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\\n outId:
 number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n wasmMirrorPad =
 backend.wasm.cwrap(MirrorPad, null /* void */, [\\n 'number', // xId\\n 'array', // x.shape\\n 'number', //

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x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', //
mode\n 'number', // outId\n);\n}\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend:
BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const
postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n
const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n
wasmMirrorPad(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n
postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig:
KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`.\n */\n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,

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pValidOutputs};\n}\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n\n function kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices]);\n\n return selectedIndicesTensor;\n }\n\n export const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {\n KernelFunc,\n };\n };\n}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
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resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the\n
heap.\n backend.wasm._free(pSelectedScores);\n\n
const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const\n
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,\n
validOutputsTensor];\n\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:\n
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as { }\n
as KernelFunc,\n};\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under\n
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for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,\n
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from\n
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =\n
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n
 'number', //\n
scoreThreshold\n 'number', // softNmsSigma\n]);\n\n\nfunction\n
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:\n
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,\n
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =\n
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const\n
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
softNmsSigma);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from\n
the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n
backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n
return [selectedIndicesTensor, selectedScoresTensor];\n\n\nexport const nonMaxSuppressionV5Config:\n
KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: kernelFunc as { } as KernelFunc,\n};\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig,\n
NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst\n
supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n",/**\n * @license\n * Copyright 2020

```



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```
=====\n*\n\nimport\n {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\n import\n {BackendWasm} from '../backend_wasm';\n let wasmOneHot: (\n indicesId: number, depth: number, onValue:\n number, offValue: number,\n outId: number) => void;\n function setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n }\n function oneHot(\n args:\n {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n const out =\n backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n wasmOneHot(indicesId, depth, onValue,\n offValue, outId);\n }\n export const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc\n };}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from '../backend_wasm';\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:\nBackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const\nonesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as\n {} as KernelFunc\n};}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport\n {expandDims} from './ExpandDims';\nexport function pack(\n args: {inputs: PackInputs, backend:\n BackendWasm, attrs: PackAttrs}) {\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =\n attrs;\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim:\n axis}});\n }\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n });\n util.assert(\n
```

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dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\n\nexport const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppDType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n 'number', // xId\n 'array', // x.shape\n
 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n
 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n
 const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n
 if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n
// the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value:
constantValue, dtype: x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
outId = outTensorData.id;\n\n const xShapeBytes = new
Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n }\n\n export
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n const { inputs, backend } = args;\n const { x, alpha } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' });\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n }\n\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as KernelFunc\n };}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n xId: number, reduceSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =\n backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n }\n }\n}
```

```
return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
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```

```
=====\n\n*/\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const range =\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } = args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const out\n = backend.makeOutput([values.length], dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*/\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*/\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const relu6Config: KernelConfig =\n createUnaryKernelConfig(Relu6);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmResizeBilinear: (\n xId:
number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,
newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null
/*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n}\n\nfunction resizeBilinear(args: {\n backend:
BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size} =
attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n if
(castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n]);\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs}):
TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {dims} = attrs;\n const axes = util.parseAxisParam(dims, x.shape);\n if (x.shape.length
=== 0) {\n return identity({inputs: {x}, backend});\n }\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
```



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=====\n\n*\n\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n", "/**\n\n * @license\n\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless required by applicable law or agreed to in writing, software\n\n * distributed under the License is distributed on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under the License.\n\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\n function scatterNd(\n args: \n {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs});\n
```

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 TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n }\n\n export const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc:
```

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 setup,\n kernelFunc: scatterNd as { } as KernelFunc\n};\n\n", "/**\n\n * @license\n\n * Copyright 2020 Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the "License");\n\n * you may not use this file except in compliance with the License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless required by applicable law or agreed to in writing, software\n\n * distributed under the License is distributed on an "AS IS" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n * See the License for the specific language governing permissions and\n\n * limitations under the License.\n\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: {inputs: SelectInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId = backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId = backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n
```

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util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
const selectConfig:
 KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {} as KernelFunc,\n
 setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *
 =====\n
 *\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
 core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
 BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
 'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}): TensorInfo {\n
 const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
 backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n // Short-circuit
 zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n
 return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright
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 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
 =====\n
 *\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
 './unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n *
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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
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 distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
 the License.\n *
 =====\n
 *\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
 number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
 'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: {backend: BackendWasm,
 inputs:
 SoftmaxInputs, attrs: SoftmaxAttrs}): TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} = args;\n
 const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
 logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n

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const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {padV2Config} from
'./PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs}
= args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod =
util.sizeFromShape(blockShape);\n\n const completePaddings: Array<number, number> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<number, number>));\n\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n}) as TensorInfo;\n\n const
reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
 const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:

```

```

SplitVAttrs, backend: BackendWasm}) {\n const {inputs, attrs,
 backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const squaredDifferenceConfig: KernelConfig
=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n"/**\n * @license\n * Copyright
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:

```

```

BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n
'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {backend:
BackendWasm, inputs: StepInputs, attrs: StepAttrs});\n\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasStep(xId, alpha, CppDType[x.dtype], outId);\n return out;\n}\n\n\nexport const stepConfig: KernelConfig = {\n
kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as { } as
KernelFunc\n};\n\n", /**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nimport {slice} from './Slice';\n\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number',
// outShapeLength\n 'number', // outId\n]);\n}\n\n\nexport function stridedSlice(args: {\n backend:
BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n
ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n
finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n
} =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n
newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous (only
occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n
backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n
new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n", /**\n *

```

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```
=====\n*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
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```
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```

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape, reduceShape]\n =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n }\n\n export const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n };\n "/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
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compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (n xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', // x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} = attrs;\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out = backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CCppType[out.dtype], outId);\n return out;\n}\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: tile as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTopK:
```

```

(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean, outValuesId:
 number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK =
backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n
'number', // outIndicesId\n]);\n\n \nextport const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n
 const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n
 const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
 const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n
};\n\n \nextport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: topk as { } as KernelFunc,\n };,\n "/**\n * @license\n * Copyright 2021 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:
number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:
number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number',
// batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', //
imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //
interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n\n \nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n \n const out = backend.makeOutput(outShape, image.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case
'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n
 case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n \n wasmTransform(\n imageId, transformsId,

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(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n}\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {slice} from './Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis < 0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank = value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank; i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size, backend}});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\n//\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile the library. A modular build would replace\n// the contents of this file and import only the kernels that are needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from

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./kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}
from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
{ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
{concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
 './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport
 {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
 {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
 {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
 {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
 {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
 {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
 {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
 {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig}
 from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport {negConfig} from
 './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';\nimport
 {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config}
 from './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport
 {oneHotConfig} from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport
 {packConfig} from './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
 {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
 from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
 from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
 {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
 {softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport

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WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"]}var scriptDirectory=""";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof

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console===\undefined\");console={};console.log=print;console.warn=console.error=typeof
printErr!==\undefined"?printErr:print} }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!==\undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !== \undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\")!=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs\");if(!nodePath)nodePath=require(\path\");filename=n
odePath[\normalize\](filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret} }else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200|xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title} }else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\undefined\"){global.performance=require(\perf_hooks\").performance} }var
out=Module[\print\"]||console.log.bind(console);var err=Module[\printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\arguments\"])arguments_=Module[\arguments\"];if(Module[\thisProgram\"])thisProgram=
Module[\thisProgram\"];if(Module[\quit\"])quit_=Module[\quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)} }var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\wasmBinary\"])wasmBinary=Module[\wasmBinary\"];var
noExitRuntime=Module[\noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort(\no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort(\Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[_"+ident];assert(func,\Cannot call unknown function \"+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\string":function(str){var ret=0;if(str===null&&str!==undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string\)return UTF8ToString(ret);if(returnType===\boolean\)return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]} } }var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number\});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} }function

```

```

UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){ var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){ str+=String.fromCharCode(u0);continue } var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue } var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2 } else { u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63 } if(u0<65536){ str+=String.fromCharCode(u0) } else { var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023) } } return str } function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):"" } function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){ if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023 } if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++
]=u } else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63 } else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63 } else { if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63 } } heap[outIdx]=0;return outIdx-startIdx } function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite) } function lengthBytesUTF8(str){ var
len=0;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4 } return len } function
writeArrayToMemory(array,buffer){ GROWABLE_HEAP_I8().set(array,buffer) } function
alignUp(x,multiple){ if(x%multiple>0){ x+=multiple-x%multiple } return x } var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf) } var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){ wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]} else { if(Module["wasmMemory"]){ wasmMemory=
Module["wasmMemory"]} else { wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){ err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){ console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")} throw Error("bad
memory") } } if(wasmMemory){ buffer=wasmMemory.buffer } INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){ __wasm_call_ctor
s() }});function
preRun(){ if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){ if(typeof
Module["preRun"]==="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){ a
ddOnPreRun(Module["preRun"].shift()) } callRuntimeCallbacks(__ATPRERUN__) } function

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initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency
cannot be used in a pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((ru
nDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return
response["arrayBuffer"]()})).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-
instantiate")})))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return

```

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WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: \""+reason);abort(reason)}}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \""+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \""+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emscripten_futex_wake\"]=_emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio

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n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`Internal Error! cancelThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`Internal Error! Null pthread_ptr in
cancelThread!\`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd\`:\`cancel\`"})function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`Internal Error! cleanupThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`Internal Error! Null pthread_ptr in
cleanupThread!\`;var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb);initWorker:function(){,t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\`:\`exit\`"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\`:\`cancelDone\`"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var

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thread=PThread.pthreads[d.targetThread];if(thread){ thread.worker.postMessage(e.data,d[\"transferList\"])}else {con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d[\"targetThread\"]+\", but that
thread no longer
exists!\")}PThread.currentProxiedOperationCallerThread=undefined;return }if(cmd===\"processQueuedMainThread
Work\"){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d[\"thread\"])}else
if(cmd===\"killThread\"){killThread(d[\"thread\"])}else
if(cmd===\"cancelThread\"){cancelThread(d[\"thread\"])}else
if(cmd===\"loaded\"){ worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{ worker.runPthread();delete
worker.runPthread } else if(cmd===\"print\"){out(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else
if(cmd===\"printErr\"){err(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"alert\"){alert(\"Thread
\"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)} }else
if(cmd===\"exitProcess\"){try {exit(d[\"returnCode\"])}catch(e){if(e instanceof ExitStatus)return;throw e } }else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){ worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\'"+cmd)\")}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\":\"+e.lineno+\":
\'+e.message)};if(ENVIRONMENT_IS_NODE){ worker.on(\"message\",function(data){ worker.onmessage({ data:d
ata})});worker.on(\"error\",function(data){ worker.onerror(data)});worker.on(\"exit\",function(data){})} } worker.post
Message({\"cmd\": \"load\", \"urlOrBlob\": Module[\"mainScriptUrlOrBlob\"]|_scriptDir, \"wasmMemory\": wasmMe
mory, \"wasmModule\": wasmModule}),allocateUnusedWorker:function(){ var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){ var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){ abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\'+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){ var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6 } }else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\": \"processQueuedMainThreadWork\"})} }else

```



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if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread":targetThreadId,"cmd": "processThreadQueue"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd": "processThreadQueue"})}return 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret=== "timed-out")return-
73;if(ret=== "not-equal")return-6;if(ret=== "ok")return
0;throw "Atomics.wait returned an unexpected value
"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return
navigator["hardwareConcurrency"]}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);return
ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf];++buf)}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var

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newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true }return false }var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var

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targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension(\"ANGLE_instanced_arrays\");if(ext){ctx[\"vertexAttribDivisor\"]=function(index,divisor){ex
t[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcou
nt){ext[\"drawArraysInstancedANGLE\"](mode,first,count,primcount)};ctx[\"drawElementsInstanced\"]=function(
mode,count,type,indices,primcount){ext[\"drawElementsInstancedANGLE\"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension(\"OES_vertex_array_object\");if(ext){ctx[\"createVertexArray\"]=function(){return
ext[\"createVertexArrayOES\"]();ctx[\"deleteVertexArray\"]=function(vao){ext[\"deleteVertexArrayOES\"](vao)};
ctx[\"bindVertexArray\"]=function(vao){ext[\"bindVertexArrayOES\"](vao)};ctx[\"isVertexArray\"]=function(vao)
{return ext[\"isVertexArrayOES\"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension(\"WEBGL_draw_buffers\");if(ext){ctx[\"drawBuffers\"]=function(n,bufs){ext[\"drawBuffers
WEBGL\"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension(\"WEBGL_multi_dra

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w\"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
 recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;ii++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="\";for(var i=0;i<count;ii++){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\undefined\|webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\object\|JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\lose_context\")<0&&ext.inde
xOf(\debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;ii++){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\)\"){name=name.slice(0,name.lastIndexOf(\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;ii++){var
n=name+\\"+j+\\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=[\default\",low-power\",high-performance\"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\p

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remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerformanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)];var canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function _emscripten_webgl_create_context(a0,a1){return _emscripten_webgl_do_create_context(a0,a1)}var SYSCALLS={ mappings: {}, buffers: [null, [], []], printChar: function (stream, curr) { var buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));buffer.length=0}else{buffer.push(curr)}}, varargs: undefined, get: function () { SYSCALLS.varargs+=4; var ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret }, getStr: function (ptr) { var ret=UTF8ToString(ptr);return ret }, get64: function (low, high) { return low } }; function _fd_close(fd) { if (ENVIRONMENT_IS_PTHREAD) return _emscripten_proxy_to_main_thread_js(3,1,fd);return 0 } function _fd_seek(fd, offset_low, offset_high, whence, newOffset) { if (ENVIRONMENT_IS_PTHREAD) return _emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset) } function _fd_write(fd, iov, iovcnt, pnum) { if (ENVIRONMENT_IS_PTHREAD) return _emscripten_proxy_to_main_thread_js(5,1,fd,iov,iovcnt,pnum); var num=0; for (var i=0; i<iovcnt; i++) { var ptr=GROWABLE_HEAP_I32()[iov+i*8>>2]; var len=GROWABLE_HEAP_I32()[iov+(i*8+4)>>2]; for (var j=0; j<len; j++) { SYSCALLS.printChar(fd, GROWABLE_HEAP_U8()[ptr+j]) } num+=len } GROWABLE_HEAP_I32()[pnum>>2]=num; return 0 } function _pthread_cleanup_pop(execute) { var routine=PThread.threadExitHandlers.pop(); if (execute) routine() } function _pthread_cleanup_push(routine, arg) { PThread.threadExitHandlers.push(function () { wasmTable.get(routine)(arg) }) } function spawnThread(threadParams) { if (ENVIRONMENT_IS_PTHREAD) throw \"Internal Error! spawnThread() can only ever be called from main application thread!\"; var worker=PThread.getNewWorker(); if (worker.pthread!==undefined) throw \"Internal error!\"; if (!threadParams.pthread_ptr) throw \"Internal error, no pthread ptr!\"; PThread.runningWorkers.push(worker); var tlsMemory=_malloc(128*4); for (var i=0; i<128; ++i) { GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0 } var stackHigh=threadParams.stackBase+threadParams.stackSize; var pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker, stackBase:threadParams.stackBase, stackSize:threadParams.stackSize, allocatedOwnStack:threadParams.allocatedOwnStack, threadInfoStruct:threadParams.pthread_ptr }; var tis=pthread.threadInfoStruct>>2; Atomics.store(GROWABLE_HEAP_U32(), tis+(64>>2), threadParams.detached); Atomics.store(GROWABLE_HEAP_U32(), tis+(100>>2), tlsMemory); Atomics.store(GROWABLE_HEAP_U32(), tis+(40>>2), pthread.threadInfoStruct); Atomics.store(GROWABLE_HEAP_U32(), tis+(80>>2), threadParams.stackSize); Atomics.store(GROWABLE_HEAP_U32(), tis+(76>>2), stackHigh); Atomics.store(GROWABLE_HEAP_U32(), tis+(104>>2), threadParams.stackSize); Atomics.store(GROWABLE_HEAP_U32(), tis+(104+8>>2), stackHigh); Atomics.store(GROWABLE_HEAP_U32(), tis+(104+12>>2), threadParams.detached); var global_libc=_emscripten_get_global_libc(); var global_locale=global_libc+40; Atomics.store(GROWABLE_HEAP_U32(), tis+(172>>2), global_locale); worker.pthread=pthread; var msg={ \"cmd\": \"run\", \"start_routine\": threadParams.startRoutine, \"arg\": threadParams.arg, \"threadInfoStruct\": threadParams.pthread_ptr, \"stackBase\": threadParams.stackBase, \"stackSize\": threadParams.stackSize }; worker.runPthread=function () { msg.time=performance.now(); worker.postMessage(msg, threadParams.transferList) }; if (worker.loaded) { worker.runPthread(); delete worker.runPthread } } function _pthread_create(pthread_ptr, attr, start_routine, arg) { if (typeof SharedArrayBuffer===\"undefined\") { err(\"Current

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environment does not support SharedArrayBuffer, pthreads are not available!");return
6}if(!pthread_ptr){err("pthread_create called with a null thread pointer!");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==-0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[(threadInfoStruct>>2)+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd="\spawnThread";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw"Canceled!"}function
_emsripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce("Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread")}function
__emsripten_do_pthread_join(thread,status,block){if(!thread){err("pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err("PThread
"+"thread+" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emsripten_main_browser_thread_id()===thread){err("Main
thread"+"thread+" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!===thread){err("pthread_join attempted on thread
"+"thread+", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("Attempted to join thread
"+"thread+", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emsripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus===1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emsripten_main_thre
ad_process_queued_calls();_emsripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
__pthread_join(thread,status){return __emsripten_do_pthread_join(thread,status,true)}function
__sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case

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159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case
76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,
\"c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscrip
ten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap

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ply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]()["P"]).a
ply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm"]()["Q"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]()["R"]).apply(null,argument
s)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["
asm"]()["S"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]()["T"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm"]()["U"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]()["V"]).apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]()["W"]).apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]
=Module["asm"]()["X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]()["Y"]).a
ply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=M
odule["asm"]()["Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=M
odule["_DepthwiseConv2dNative"]=Module["asm"]()["_"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]()["$"]).apply(null,arguments)
};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]()["aa"]).apply(null,ar
guments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]()["ba"]).apply(null,argument
s)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Modu
le["asm"]()["ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]()["da"]).apply(null,arg
uments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]()["ea"]).
apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchN
orm"]=Module["asm"]()["fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Modu
le["asm"]()["ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=M
odule["_FusedDepthwiseConv2D"]=Module["asm"]()["ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]()["ia"]).apply(nu
l,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]()["ja"
]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]()["ka"]).apply(

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null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"]["\la").apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"]["\ma").apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"]["\na").apply(null,arguments));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"]["\oa").apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"]["\pa").apply(null,arguments));var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"]["\qa").apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"]["\ra").apply(null,arguments));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"]["\sa").apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"]["\ta").apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"]["\ua").apply(null,arguments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"]["\va").apply(null,arguments));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"]["\wa").apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"]["\xa").apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"]["\ya").apply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"]["\za").apply(null,arguments));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"]["\Aa").apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"]["\Ba").apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"]["\Ca").apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"]["\Da").apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"]["\Ea").apply(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"]["\Fa").apply(null,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"]["\Ga").apply(null,arguments));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"]["\Ha").apply(null,arguments));var

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_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var

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_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){return(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscripten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Module["__emscripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).a

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ply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]
)[["zb"]].apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"])[["Ab"]
].apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_
limits=Module["_emsripten_stack_set_limits"]=Module["asm"])[["Bb"]].apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"])[["Cb
"]].apply(null,arguments)};var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=1
0512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1});doRun(),1)}else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n));\nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"]
= WasmBackendModuleThreadedSimd;\n","export const wasmWorkerContents = 'var Module={};function
threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function
threadAlert(){var text=Array.prototype.slice.call(arguments).join(
"\n");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var

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objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})else
if(e.data.cmd===\"objectTransfer\"){Module[\"PThread\"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\"run\"){Module[\"__performance_now_clock_drift\"]=performance.now()-
e.data.time;Module[\"__emscripten_thread_init\"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[\"establishStackSpace\"](top,max);Module[\"__emscripten_tls_init\"](
);Module[\"PThread\"].receiveObjectTransfer(e.data);Module[\"PThread\"].setThreadStatus(Module[\"_pthread_self
\")(0,1);try{var
result=Module[\"invokeEntryPoint\"](e.data.start_routine,e.data.arg);if(!Module[\"getNoExitRuntime\"]())Module[
\"PThread\"].threadExit(result)}catch(ex){if(ex===\"Canceled!\"){Module[\"PThread\"].threadCancel()}else
if(ex!==\"unwind\")if(ex instanceof
Module[\"ExitStatus\"]){if(Module[\"getNoExitRuntime\"]()){else{Module[\"PThread\"].threadExit(ex.status)}}el
se{Module[\"PThread\"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd===\"cancel\")if(Module[\"_pthread_self\"]()){Module[\"PThread\"].threadCancel()}else
if(e.data.target===\"setimmediate\")else
if(e.data.cmd===\"processThreadQueue\")if(Module[\"_pthread_self\"]()){Module[\"__emscripten_current_thread_
process_queued_calls\"]()}else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)}}catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}};\", \"nvar
WasmBackendModule = (function() {\n var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=\"undefined\"?WasmBackendModule: {} ;var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"] =new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }}var
arguments_=[];var thisProgram= \"/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var

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nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\/g,\"/\"})arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else
if(typeof arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\")if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir;if(scriptDirectory.indexOf(\"blob:\")!=\"0\")scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){abort(\"no native wasm
support detected\")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort(\"Assertion failed:
\'+text\")}}function getCFunc(ident){var func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function
\'+ident+\", make sure it is exported\");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\"string\":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\"array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]

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]=args[i] } } var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==(0))stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} } var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{ var
str="";while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{ var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} } }return str}function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else {if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63} }heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){ addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep

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dependencies\")(runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}what+=\"\\\";err(what);ABORT=true;EXITSTAT
US=1;what=\"abort(\\\"+what+\\\"). Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-
wasm.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\\\"+wasmBinaryFile+\\\"\"}return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\")}addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \\\"+reason);abort(reason)}))}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \\\"+reason);err(\"falling
back to ArrayBuffer
instantiateation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \\\"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscipten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscipten_get_heap_size(){return HEAPU8.length}function

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emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iiov,iiovcnt,pnum){var num=0;for(var i=0;i<iiovcnt;i++){var ptr=HEAP32[iiovcnt+i*8>>2];var
len=HEAP32[iiovcnt+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case
181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case
50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case
81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case
129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case
42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return
99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return
32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case
2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return -1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var
asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var

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_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"][["p"]]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"][["q"]]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"][["s"]]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][["t"]]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["v"]]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["w"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var

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_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var

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_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var

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_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["Va"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"]]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"]("");},1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}}run();\n\n return WasmBackendModule.ready\n\n);}\n\nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function'
&& define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n", "/**\n * @license\n * Copyright 2019

```

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```
=====\n*\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn, engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule, WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from './wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public\n wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n\n this.dataIdMap = new DataStorage(this, engine());\n\n write(values: backend_util.BackendValues, shape: number[], dtype: DataType): DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(dataId: DataId, values: backend_util.BackendValues, shape: number[], dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId, {\n id, stringBytes, shape, dtype, memoryOffset: null, refCount);\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset, memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @param force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`.\n */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n }\n }\n }\n }\n }\n}
```

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 return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data =
this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n
return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n
case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new
Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,
size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n function
createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n
WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n
 });\n });\n return {};\n });\n }\n\n /**\n * Returns the path of the WASM binary.\n * @param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n
 simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null)
{\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n\n return wasmModuleFolder + path;\n }\n\n /**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n * NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n */\n export async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported, threadsSupported]
= await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n }\n return prefix
+ path;\n });\n }\n\n

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};\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n };\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the '+\n 'bundled js
file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-
bundlers';\n reject({message: rejectMsg});\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If
`wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported
&& wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob(\n [var
WasmBackendModuleThreadedSimd = `+\n wasmFactoryThreadedSimd.toString()),\n {type:
'text/javascript'});\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory
works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM
module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType:
string
= null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };\n\n resolve({wasm: module});\n
});\n });\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const ;\n\ntype WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport
function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n 'setWasmPath has
been deprecated in favor of setWasmPaths and '+\n ' will be removed in a future release.);\n if (initAborted) {\n
throw new Error(\n 'The WASM backend was already initialized. Make sure you call '+\n 'setWasmPath(`
before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * ``js\n * setWasmPaths({\n
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
``\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary

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(vanilla,\n * SIMD-enabled, threading-enabled, etc.)\n * - (object) Mapping from names of WASM binaries to
custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are
not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n *\nexport function setWasmPaths(\n prefixOrFileMap:
string|{[key in WasmBinaryName]?: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n throw
new Error(\n `The WASM backend was already initialized. Make sure you call ' +\n `setWasmPaths()
before you call `tf.setBackend() or ' +\n `tf.ready()``);\n }\n\n if (typeof prefixOrFileMap === 'string') {\n
wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const
missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n if (missingPaths.length
> 0) {\n throw new Error(\n `There were no entries found for the following binaries: ` +\n
`${missingPaths.join(',')}. Please either call setWasmPaths with a ` +\n `map providing a path for each binary,
or with a string indicating ` +\n `the directory where all the binaries can be found.`);\n }\n }\n\n
customFetch = usePlatformFetch;\n}\n\n/** Used in unit tests. */\nexport function resetWasmPath(): void {\n
wasmPath = null;\n wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted =
false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be
called before calling `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads:
number) {\n threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n *\n * It is set after the backend is initialized.\n */\nexport function getThreadsCount(): number {\n if
(actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return
actualThreadsCount;\n}\n\n"/** @license See the LICENSE file. */\n\n// This code is auto-generated, do not modify
this file!\nconst version = '3.11.0';\nexport {version};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */

```

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=====\n
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n},
WASM_PRIORITY);\n\n], "names":["_FusedMatMul","util","Abs","backend_util","Add","AddN","Identity","setup",
"Transpose","All","Any","wasmFunc","ArgMax","AvgPool","Reshape","BatchMatMul","slice_util","buffer","sliceI
mplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2
DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","s
upportsFullBroadcast","Equal","Exp","ExpandDims","Fill","FlipLeftRight","Floor","FloorDiv","FusedBatchNorm",
"FusedConv2D","FusedDepthwiseConv2D","GatherNd","GatherV2","Greater","GreaterEqual","setupFunc","Leaky
Relu","Less","LessEqual","Log","LogicalAnd","Max","Maximum","MaxPool","Mean","Min","Minimum","Mirror
Pad","Multiply","Neg","NonMaxSuppressionV3","NonMaxSuppressionV4","NonMaxSuppressionV5","kernelFunc
","NotEqual","OneHot","OnesLike","Pack","PadV2","Pow","Prelu","Prod","rangeImplCPU","Range","RealDiv","R
elu","Relu6","ResizeBilinear","Reverse","RotateWithOffset","Round","Rsqrt","ScatterNd","Select","Sigmoid","Sin
","Softmax","SpaceToBatchND","SplitV","Sqrt","Square","SquaredDifference","Step","StridedSlice","Sub","Sum",
"Tan","Tanh","Tile","TopK","Transform","Unpack","ZerosLike","registerKernel","env","require$$0","require$$1",

```

"require\$\$2", "global", "require\$\$3", "require\$\$4", "tslib\_1.\_\_extends", "DataStorage", "engine", "KernelBackend", "wasmFactoryThreadedSimd", "wasmFactory", "deprecationWarn", "registerBackend"], "mappings": ";;;;;;;;;;;;;EAAA;;;;;;;;;;EaIBa;EACA,IAAY,QAMX;EAND,WAAY,QAAQ;MACIB,6CAAW,CAAA;MACX,yCAAS,CAAA;MACT,uCAAQ,CAAA;MACR,2CAAU,CAAA;MACV,iDAAa,CAAA;EACf,CAAC,EANW,QAAQ,KAA R,QAAQ,QAMnB;EAED;EACA,IAAY,iBAQX;EARD,WAAY,iBAAiB;MAC3B,6DAAU,CAAA;MACV,yDAA Q,CAAA;MACR,2DAAS,CAAA;MACT,2DAAS,CAAA;MACT,mEAAa,CAAA;MACb,+DAAW,CAAA;MACX, uDAAO,CAAA;EACT,CAAC,EARW,iBAAiB,KAAjB,iBAAiB;;EC3B7B;;;;;;;;;;;EAuBA,IAAI,eAKQ,CAAC; EAEb,SAAS,KAAC,CAAC,OAAoB;MACjC,eAAe,GAAG,OAAO,CAAC,IAAI,CAAC,KAAC,CAACA,qBAAY, EAAE,IAAI,aAAa;UACIE,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,QAAQ;UACR,OAAO;UACP,QAAQ;UA CR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CA AC,CAAC;EAEL,CAAC;EAED,SAAS,gBAAGB,CAAC,IAIzB;MACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kB AAK,CAAS;MAC/B,IAAA,YAAC,EAAE,YAAC,EAAE,kBAAI,EAAE,sDAAsB,CAAW;MAEpD,IAAI,CAAC,C AAC,KAAC,KAAC,SAAS,IAAI,CAAC,CAAC,KAAC,KAAC,SAAS,EAAE;UACID,MAAM,IAAI,KAAC,CAC X,6DAA6D,CAAC,CAAC;OACpE;MAEM,IAAA,6BAAU,EAAE,6BAAU,EAAE,6BAAU,EAAE,qCAAc,CAU; MACnE,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC, EAAE,CAAC;MAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM, CAAC,CAAC,EAAE,CAAC;MAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;MACf,IAAI,IAAI,IAAI,IAAI,EAAE;U AChB,IAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;UA CpD,IAAI,QAAQ,CAAC,KAAC,CAAC,MAAM,KAAC,CAAC,EAAE;cAC/B,MAAM,IAAI,KAAC,CACX,iDA AiD;mBACjD,UAAQ,QAAQ,CAAC,KAAC,CAAC,MAAM,MAAG,CAAA,CAAC,CAAC;WACvC;UACD,MAA M,GAAG,QAAQ,CAAC,EAAE,CAAC;OACTb;MACD,IAAM,wBAAwB,GAAG,sBAAsB,IAAI,IAAI;UAC3D,C AAC;UACD,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC; MAC5D,IAAM,eAAe,GACjB,iBAAiB,CAAC,UAAkD,CAAC,CAAC;MACIE,IAAI,eAAe,IAAI,IAAI,EAAE;UA C3B,MAAM,IAAI,KAAC,CACR,UAAU,mDAAGD;cAC7D,sBAAsB,CAAC,CAAC;OAC7B;MAED,IAAM,OAA O,GAAG,UAAU,GAAG,CAAC,CAAC,KAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAC,CAAC,CAA C,CAAC,CAAC;MACtD,IAAM,QAAQ,GAAG,UAAU,GAAG,CAAC,CAAC,KAAC,CAAC,CAAC,CAA G,CAAC,CAAC,KAAC,CAAC,CAAC,CAAC;MACtD,IAAM,QAAQ,GAAG,CAAC,CAAC,KAAC,CAA C,CAAC,CAAC,CAAC;MAE5B,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,QAAQ,EAAE,OAA O,EAAE,QAAQ,CAAC,EAAE,CAAC,CAAC,KAAC,CAAC,CAAC;MACvE,IAAM,KAAC,GAAG,OAAO,CAA C,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEnD,IAAM,WAAW,GA AG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAC,CAAC,CAAC,MAAM,CAAC,CAAC;MACn E,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAC,CAAC,CAAC,MAAM, CAAC,CAAC;MAEnE,eAAe,CACX,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAC,CAAC,MAAM,EAAE, GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAC,CAAC,MAAM,EACIE,UAAU,EAAE,UAAU,EAAE,eAAe,E AAE,MAAM,EAAE,wBAAwB,EACzE,cAAc,IAAI,CAAC,EAAE,KAAC,CAAC,CAAC;MAEHc,OAAO,GAAG, CAAC;EACb,CAAC;EAEM,IAAM,iBAAiB,GAaiB;MAC7C,UAAU,EAAEA,qBAAY;MACxB,WAAW,EAAE, MAAM;MACnB,SAAS,EAAE,KAAC;MACHb,UAAU,EAAE,gBAAoC;GACjD;;EC7GD;;;;;;;;;;;WAuBgB,uB AAuB,CACnC,UAAkB,EAAE,OAAkB;MACxC,IAAI,QAA6D,CAAC;MAEIE,SAAS,SAAS,CAAC,OAAoB;UA CrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAC,CAAC,UAAU,EAAE,IAAI,aAAa;cACzD,QAAQ;cACR, QAAQ;cACR,QAAQ;WACT,CAAC,CAAC;OACJ;MAED,SAAS,UAAU,CAAC,IAAiD;UAE5D,IAAA,sBAAO,E AAW,iBAAC,CAAU;UACpC,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC, MAAM,CAAC,CAAC,EAAE,CAAC;UAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC, KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KAAC,CAAC,CAAC;UAC5D,IAAM,KAAC,GAAG,OAAO,CAAC,S AAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;;UAGnD,IAAIC,aAAI,CAAC,aA Aa,CAAC,GAAG,CAAC,KAAC,CAAC,KAAC,CAAC,EAAE;cACvC,OAAO,GAAG,CAAC;WACZ;UAED,QA AQ,CAAC,GAAG,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAC,CAAC,EAAE,KAAC,CAAC,CAAC;UACxC,OA AO,GAAG,CAAC;OACZ;MAED,OAAO,EAAC,UAAU,YAAA,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,WAA AA,EAAE,UAAU,YAAA,EAAC,CAAC;EACIE;;ECpDA;;;;;;;;;;;EAoBO,IAAM,SAAS,GAAiB,uBAAuB,CAA

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xE,OAAO,CAAC,WAAW,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC;OACpC;WAAM;UACL,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,gBAAgB,EAAE,SAAS,CAAC,CAAC;UAE5D,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UAC/C,IAAM,aAAa,GACf,IAAI,UAAU,CAAC,IAAI,UAAU,CAACf,aAAI,CAAC,cAAc,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC;UACxE,IAAM,UAAU,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,MAAM,CAAC,CAAC,MAAM,CAAC,CAAC;UACjE,IAAM,QAAQ,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,IAAI,CAAC,CAAC,MAAM,CAAC,CAAC;UAC7D,IAAM,YAAY,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,QAAQ,CAAC,CAAC,MAAM,CAAC,CAAC;UAErE,IAAM,gBAAgB,GACIB,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,gBAAgB,CAAC,CAAC,MAAM,CAAC,CAAC;UAC5D,IAAM,eAAe,GAAG,IAAI,UAAU,CACIC,IAAI,UAAU,CAACA,aAAI,CAAC,cAAc,CAAC,gBAAgB,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC;UACIE,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UAEEnD,gBAAgB,CACZ,GAAG,EAAE,aAAa,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,UAAU,EAAE,QAAQ,EAAE,YAAY,EACtE,gBAAgB,EAAE,eAAe,EAAE,gBAAgB,CAAC,MAAM,EAAE,KAAK,CAAC,CAAC;UAEvE,MAAM,GAAG,OAAO,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,GAAG,EAAC,EAAE,OAAO,SAAA,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,UAAU,EAAC,EAAC,CAAC,CAAC;UAEIE,OAAO,CAAC,WAAW,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC;OACjC;MAED,OAAO,MAAM,CAAC;EACbB,CAAC;EAE M,IAAM,kBAaKB,GAAiB;MAC9C,UAAU,EAAEiG,qBAAY;MACxB,WAAW,EAAE,MAAM;MACnB,SAAS,EAAE3F,OAAK;MACHB,UAAU,EAAE,YAAGc;GAC7C;;EC/HD;,,,,,,,,,,,,;EakBA,IAAM4B,uBAaQB,GAAG,IAAI,CAAC;EAC5B,IAAM,SAAS,GACIB,wBAawB,CAACgE,YAAG,EAAEhE,uBAaQB,CAAC;;ECpBxD;,,,,;,,,,;EawBA,IAAI,OACI,CAAC;EAET,SAAS5B,OAAK,CAAC,OAAoB;MACjC,OAAO,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC6F,YAAG,EAAE,IAAI,WAAW;UAC/C,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAEL,CAAC;EAED,SAAS,GAAG,CAAC,IAAgE;MAEpE,IAAA,sBAAO,EAAE,oBAAM,EAAE,kBAAK,CAAS;MAC/B,IAAA,iBAAI,EAAE,yBAAQ,CAAU;MACxB,IAAA,YAAC,CAAW;MACnB,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,IAAI,OAAO,GAAG,GAAG,CAAC;MACIB,IAAI,KAAK,GAAG,CAAC,CAAC;MAER,IAAA,8CACuC,EADtC,0BAAU,EAAE,cAAI,EAAE,8BAAY,EAAE,0CACM,CAAC;MAE9C,IAAI,aAAa,GAAG,IAAI,CAAC;MACzB,IAAI,kBAaKB,EAAE;UACtB,IAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UACjE,IAAI,YAAY,KAAK,GAAG,EAAE;;cAGxB,KAAK,GAAG,UAAU,CAAC;cACnB,OAAO,GAAG,YAAY,CAAC;cACvB,aAAa,GAAGjG,qBAAY,CAAC,gBAAgB,CACzC,aAAa,CAAC,MAAM,EAAE,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;WAC/C;OACF;MAEDA,qBAAY,CAAC,0BAA0B,CACnC,KAAK,EAAE,aAAa,EAAE,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;MACxC,IAAA,gFACgE,EAD/D,gBAAQ,EAAE,mBACqD,CAAC;MACvE,IAAM,UAAU,GAAGF,aAAI,CAAC,aAAa,CAAC,WAAW,CAAC,CAAC;MAEnD,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,KAAK,CAAC,KAAK,CAAC,CAAC;MACtD,IAAIA,aAAI,CAAC,aAAa,CAAC,KAAK,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;UACzC,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UACnD,OAAO,CAAC,OAAO,EAAE,UAAU,EAAE,QAAQ,CAAC,GAAG,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;OACID;MAED,IAAI,kBAaKB,EAAE;;UAEtB,OAAO,CAAC,WAAW,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC;OACxC;MAED,IAAI,QAAQ,EAAE;;UAEZ,IAAM,QAAQ,GAAGE,qBAAY,CAAC,oBAAoB,CAAC,GAAG,CAAC,KAAK,EAAE,YAAY,CAAC,CAAC;UAC5E,GAAG,CAAC,KAAK,GAAG,QAAQ,CAAC;OACtB;MAED,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,IAAM,SAAS,GAAiB;MACrC,UAAU,EAAEiG,YAAG;MACf,WAAW,EAAE,MAAM;MACnB,SAAS,EAAE7F,OAAK;MAChB,UAAU,EAAE,GAAuB;GACpC;;EC5FD;,,,,,,,,,,,,;EAmBO,IAAM,SAAS,GAAiB,uBAAuB,CAAC8F,YAAG,CAAC;;ECnBnE;,,,,,,,,,,,,;EAmBO,IAAM,UAAU,GAAiB,uBAAuB,CAACC,aAAI,CAAC;;ECnBrE;,,,,,,,,,,,,;EAuBA,IAAI,QAEE2D,CAAC;EAEEhE,SAAS/F,OAAK,CAAC,OAAoB;MACjC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACgG,aAAI,EAAE,IAAI,aAAa;UACnD,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAEL,CAAC;EAED,SAAS,IAAI,CACT,IAAKE;MAC7D,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;MAC/B,IAAA,YAAC,CAAW;MACnB,IAAM,GAAG,GAA G,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACxC,IAA

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CT,OAAO,EAAE,YAA Y,GAAG,UAAU,CAAC,KA AK,CAAC,CAAC,CAAC,GAAG,CAAC,GAAG,KA AK,EAA E,SAAS,EACIE,QAAQ,EAAE,WAAW,EAAE,UAAU,EAAE,WAAW,EAAE,OAAO,EACvD,KA AK,CAAC,KA AK,CAAC,MAAM,GAAG,CAAC,EAAE,mBAAmB,EAAE,UAAU,EAAE,SAAS,EACIE,KA AK,CAAC,CAAC; MAEX,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,IAAM,eAAe,GAAiB;MAC3C,UAAU,EAAEWg,kBAAS;MA CrB,WAAW,EAAE,MAAM;MACnB,SAAS,EAAEIG,OAAK;MACHb,UAAU,EAAE,SAA6B;GAC1C;;EC5GD;;; ;;;;;;;;;;;EAuBA,SAAS,MAAM,CACX,IAAsE;MAEjE,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;MA C/B,IAAA,oBAAK,CAAW;MACIB,IAAA,iBAAI,CAAU;MAEnB,IAAI,IAAI,GAAG,CAAC,EAAE;UACZ,IAAI, IAAI,KA AK,CAAC,KA AK,CAAC,MAAM,CAAC;OAC5B;MAED,IAAM,UAAU,GAAG,KA AK,CAAC,KA AK, CAAC,IAAI,CAAC,CAAC;MACrC,IAAM,IAAI,GAAG,KA AK,CAAC,KA AK,CAAC,MAAM,CAAC;MACHc,I AAM,QAAQ,GAaA,IAAI,KA AK,CAAC,IAAI,GAAG,CAAC,CAAC,CAAC;MAC/C,IAAI,QAAQ,GAAG,CAAC ,CAAC;MACjB,KA AK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,IAAI,EAAE,CAAC,EAAE,EAAE;UA C7B,IAAI,CAAC,KA AK,IAAI,EAAE;cACd,QAAQ,CAAC,QAAQ,EAAE,CAAC,GAAG,KA AK,CAAC,KA AK, CAAC,CAAC,CAAC,CAAC;WACvC;OACF;MACD,IAAM,IAAI,GAAiB,IAAI,KA AK,CAAC,UAAU,CAAC,C AAC;MACjD,IAAM,KA AK,GAAG,IAAI,KA AK,CAAC,IAAI,CAAC,CAAC,IAAI,CAAC,CAAC,CAAC,CAAC; MACtC,IAAM,IAAI,GAAG,KA AK,CAAC,KA AK,CAAC,KA AK,EAAE,CAAC;MACjC,IAAI,CAAC,IAAI,CAA C,GAAG,CAAC,CAAC;MACf,KA AK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,IAAI,CAAC,MAAM,E AAE,CAAC,EAAE,EAAE;UACpC,KA AK,CAAC,IAAI,CAAC,GAAG,CAAC,CAAC;UACHb,IAAI,CAAC,CAA C,CAAC,GAAG,KA AK,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,KA AK,EAAC,EAAE,KA AK,EAAE, EAAC,KA AK,OAAA,EAAE,IAAI,MAAA,EAAC,EAAE,OAAO,SAAA,EAAC,CAAC,CAAC;OACtE;MACD,O AAO,IAAI,CAAC,GAAG,CAAC,UAAC,EAAe;cAAd,kBAAM,EAAE,gBAAK;UAAM,QAAC,EAAC,MAAM,Q AAA,EAAE,KA AK,OAAA,EAAE,KA AK,EAAE,QAAQ,EAAC;OAA C,CAAC,CAAC;EAC3E,CAAC;EAEM,IA AM,YAA Y,GAAiB;MACxC,UAAU,EAAEmG,eAAM;MACIB,WAAW,EAAE,MAAM;MACnB,UAAU,EAAE, MAA0B;GACvC;;EC1DD;;;;;;;;;;EAqBA,SAAS,SAAS,CAAC,IAAqD;MACtD,IAAA,iBAAC,EAAG,sBAAO, CAAS;MACpC,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KA AK,EAAE,CAAC,CAAC, KA AK,CAAC,CAAC;MACjD,IAAM,OAAO,GAAG,OAAO,CAAC,kBAaKB,CAAC,GAAG,CAAC,CAAC;MAC hD,OAAO,CAAC,IAAI,CAAC,CAAC,CAAC;MACHb,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,IAAM ,eAAe,GAAiB;MAC3C,UAAU,EAAEC,kBAAS;MACrB,WAAW,EAAE,MAAM;MACnB,UAAU,EAAE,SAA6B ;GAC1C;;ECjCD;;;;;;;;;;EAsHA;EACA,IAAM,aAAa,GAAM;MACpC,SAAS;MACT,SAAS;MACT,UAAU; MACV,SAAS;MACT,SAAS;MACT,YAA Y;MACZ,aAAa;MACb,iBAAiB;MACjB,oBAAoB;MACpB,UAAU;MA CV,UAAU;MACV,iBAAiB;MACjB,YAA Y;MACZ,YAA Y;MACZ,yBAAYB;MACzB,SAAS;MACT,UAAU;MA CV,mBAAmB;MACnB,YAA Y;MACZ,kBAaKB;MACIB,2BAA2B;MAC3B,SAAS;MACT,WAAW;MACX,SAA S;MACT,gBAAGB;MACHb,UAAU;MACV,mBAAmB;MACnB,WAAW;MACX,cAAc;MACd,iBAAiB;MACjB,o BAAoB;MACpB,iBAAiB;MACjB,0BAA0B;MAC1B,cAAc;MACd,cAAc;MACd,aAAa;MACb,kBAaKB;MACIB, cAAc;MACd,eAAe;MACf,UAAU;MACV,eAAe;MACf,SAAS;MACT,gBAAGB;MACHb,SAAS;MACT,aAAa;M ACb,aAAa;MACb,UAAU;MACV,SAAS;MACT,aAAa;MACb,eAAe;MACf,cAAc;MACd,SAAS;MACT,yBAAYB ;MACzB,yBAAYB;MACzB,yBAAYB;MACzB,cAAc;MACd,YAA Y;MACZ,cAAc;MACd,UAAU;MACV,WAAW ;MACX,SAAS;MACT,WAAW;MACX,UAAU;MACV,WAAW;MACX,aAAa;MACb,UAAU;MACV,WAAW;M ACX,aAAa;MACb,oBAAoB;MACpB,aAAa;MACb,sBAAsB;MACtB,WAAW;MACX,WAAW;MACX,eAAe;MA Cf,YAA Y;MACZ,aAAa;MACb,SAAS;MACT,WAAW;MACX,aAAa;MACb,oBAAoB;MACpB,YAA Y;MACZ,U AAU;MACV,YAA Y;MACZ,uBAAuB;MACvB,UAAU;MACV,kBAaKB;MACIB,SAAS;MACT,SAAS;MACT,S AAS;MACT,UAAU;MACV,UAAU;MACV,UAAU;MACV,eAAe;MACf,eAAe;MACf,YAA Y;MACZ,eAAe;GAC hB,CAAC;EA EF,KAA2B,UAAa,EAAb,+BAAa,EAAb,2BAAa,EAAb,IAAa,EAAE;MAArC,IAAM,YAA Y,sBAA A;MACrBC,uBAAc,CAAC,YAA Y,CAAC,CAAC;;;;;;;;;;EC3N/B;;;;;;;;;; ;;;EAIbA,sBA0CA;EAxCa,IAAM,GAAG,GAAGC,YAAG,EAAE,CAAC;EAElB;;EAGA;EACA,GAAG,CAAC, YAA Y;EACZ;EACA;EACA;EACA,uBAAuB,EAAE;;UAA Y,sBAAA,WAAW,CAAC,QAAQ,CAAC,IAAI,UAA U,CAAC;kBACvE,CAAC,EAAE,EAAE,EAAE,GAAG,EAAE,GAAG,EAAE,CAAC,EAAE,CAAC,EAAE,CAAC, EAAE,CAAC,EAAE,CAAC,EAAG,CAAC,EAAE,CAAC,EA AI,EAAE,EAAE,CAAC,EAAG,CAAC,EAAE,CAA C;kBACrD,CAAC,EAAE,CAAC,EAAG,CAAC,EA AI,EAAE,EAAG,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,

CAAC,EAAE,EAAE,EAAE,CAAC,EAAE,GAAG,EAAE,EAAE,EAAE,EAAE,EAAE,EAAE;eACpD,CAAC,CAAC,EAAA;;OAAA,CAAC,CAAC;EAET;;;EAGA;EACA,GAAG,CAAC,YAAY,CAAC,8BAA8B,EAAE;;;UAG/C,IAAI,GAAG,CAAC,GAAG,CAAC,SAAS,CAAC,EAAE;cACtB,sBAAO,KAAK,EAAC;WACd;UAED,IAAI;;;cAGF,IAAI,cAAc,EAAE,CAAC,KAAK,CAAC,WAAW,CAAC,IAAI,iBAaiB,CAAC,CAAC,CAAC,CAAC,CAAC;;;cAGjE,sBAAO,WAAW,CAAC,QAAQ,CAAC,IAAI,UAAU,CAAC;sBACzC,CAAC,EAAE,EAAE,EAAE,GAA G,EAAE,GAAG,EAAE,CAAC,EAAE,CAAC,EAAG,CAAC,EAAG,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,C AAC,EAAG,EAAE,EAAE,CAAC,EAAI,CAAC,EAAG,CAAC,EAAE,CAAC,EAAE,CAAC,EAAG,CAAC,EAAE ,CAAC;sBACpE,CAAC,EAAE,CAAC,EAAG,CAAC,EAAI,CAAC,EAAI,CAAC,EAAE,EAAE,EAAE,EAAE,EA AE,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE,EAAE,EAAE,CAAC,EAAG,GAAG,EAAE,EAAE,EAAE,CAAC, EAAE,CAAC,EAAE,EAAE,EAAE,EAAE;mBACnE,CAAC,CAAC,EAAC;WACL;UAAC,OAAO,CAAC,EAAE;c ACV,sBAAO,KAAK,EAAC;WACd;;;OACF,CAAC;;;;;;;ECzDF,IAAI,6BAA6B,GAAG,CAAC,WAAW;EAChD, EAAE,IAAI,UAAU,GAAG,OAAO,QAAQ,KAAK,WAAW,IAAI,QAAQ,CAAC,aAAa,GAAG,QAAQ,CAAC,aA Aa,CAAC,GAAG,GAAG,SAAS,CAAC;EACtH,EAAE,IAAI,OAAO,UAAU,KAAK,WAAW,EAAE,UAAU,GAA G,UAAU,IAAI,UAAU,CAAC;EAC/E,EAAE;EACF,SAAS,6BAA6B,EAAE;EACxC,EAAE,6BAA6B,GAAG,6BA A6B,IAAI,EAAE,CAAC;AACTE;EACA,SAAS,gBAAgB,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,M AAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC,MAAM,EAAC,CAAC,OAAO,KAAK,CAAC,SAAS,gBAAg B,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC,M AAM,EAAC,CAAC,OAAO,MAAM,CAAC,SAAS,iBAaiB,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE, MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC,MAAM,EAAC,CAAC,OAAO,MAAM,CAAC,SAAS,iBA AiB,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC, MAAM,EAAC,CAAC,OAAO,OAAO,CAAC,SAAS,iBAaiB,EAAE,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE ,MAAM,CAAC,CAAC,0BAA0B,CAAC,UAAU,CAAC,MAAM,EAAC,CAAC,OAAO,OAAO,CAAC,IAAI,MAA M,CAAC,OAAO,6BAA6B,GAAG,WAAW,CAAC,6BAA6B,CAAC,EAAE,CAAC,IAAI,mBAAmB,CAAC,kBA AkB,CAAC,MAAM,CAAC,OAAO,CAAC,CAAC,IAAI,OAAO,CAAC,SAAS,OAAO,CAAC,MAAM,CAAC,CAA C,mBAAmB,CAAC,OAAO,CAAC,kBAaKB,CAAC,OAAM,CAAC,CAAC,CAAC,IAAI,eAAe,CAAC,EAAE,CA AC,IAAI,GAAG,CAAC,IAAI,GAAG,IAAI,MAAM,CAAC,CAAC,GAAG,MAAM,CAAC,cAAc,CAAC,GAAG,C AAC,CAAC,CAAC,eAAe,CAAC,GAAG,CAAC,CAAC,MAAM,CAAC,GAAG,EAAC,CAAC,CAAC,IAAI,UAA U,CAAC,EAAE,CAAC,IAAI,WAAW,CAAC,gBAAgB,CAAC,IAAI,KAAK,CAAC,SAAS,MAAM,CAAC,OAAO ,CAAC,CAAC,MAAM,OAAO,CAAC,CAAC,IAAI,kBAaKB,CAAC,KAAK,CAAC,IAAI,qBAaqB,CAAC,KAA K,CAAC,IAAI,mBAAmB,CAAC,KAAK,CAAC,IAAI,oBAAoB,CAAC,KAAK,CAAC,kBAaKB,CAAC,OAAO, MAAM,GAAG,QAAQ,CAAC,qBAaqB,CAAC,OAAO,aAAa,GAAG,UAAU,CAAC,mBAAmB,CAAC,OAAO,O AAO,GAAG,QAAQ,EAAE,OAAO,OAAO,CAAC,QAAQ,GAAG,QAAQ,EAAE,OAAO,OAAO,CAAC,QAAQ,C AAC,IAAI,GAAG,QAAQ,CAAC,oBAAoB,CAAC,CAAC,kBAaKB,EAAE,CAAC,mBAAmB,EAAE,CAAC,qBA AqB,CAAC,IAAI,sBAAsB,CAAC,MAAM,CAAC,wBAawB,CAAC,EAAE,KAAK,CAAC,GAAG,sBAAsB,CAA C,CAAC,MAAM,CAAC,MAAM,CAAC,QAAQ,EAAC,CAAC,IAAI,eAAe,CAAC,EAAE,CAAC,SAAS,UAAU,C AAC,IAAI,CAAC,CAAC,GAAG,MAAM,CAAC,YAAY,CAAC,CAAC,CAAC,OAAO,MAAM,CAAC,YAAY,C AAC,CAAC,IAAI,CAAC,eAAe,CAAC,CAAC,OAAO,eAAe,CAAC,IAAI,KAAK,KAAK,CAAC,SAAS,CAAC,U AAU,CAAgB,IAAI,MAAM,CAAC,IAAI,QAAQ,CAAC,GAAG,mBAAmB,CAAC,CAAC,GAAG,qBAaqB,CAA C,CAAC,eAAe,CAACC,IAAe,CAAC,OAAO,CAAC,eAAe,CAAC,CAAC,IAAG,CAAC,KAAI,CAAC,eAAe,CAA C,SAAS,CAAC,IAAG,CAAC,KAAK,CAAC,SAAS,UAAU,CAAC,QAAQ,CAAC,MAAM,CAAC,CAAC,GAAG, CAAC,MAAM,CAAC,MAAM,CAACC,EAAa,CAAC,GAAG,CAAC,QAAQ,CAAC,QAAQ,CAACD,IAAe,CAA C,QAAQ,CAAC,QAAQ,CAAC,WAAW,CAAC,CAAC,QAAQ,CAAC,CAAC,OAAO,MAAM,CAAC,cAAc,CAA C,CAAC,QAAQ,CAAC,MAAM,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC,CAAC,UAAU,CAAC,SAAS,UAAU, CAAC,QAAQ,CAAC,CAAC,IAAI,GAAG,CAAC,KAAK,CAAC,QAAQ,CAAC,IAAI,CAAC,CAAC,GAAG,CAA C,GAAG,CAAC,MAAM,CAAC,CAAC,GAAG,CAAC,IAAI,UAAU,CAAC,GAAG,EAAC,CAAC,MAAM,CAAC ,GAAG,CAAC,MAAM,CAAC,CAAC,OAAO,GAAG,CAAC,CAAC,GAAG,OAAO,CAAC,MAAM,CAAC,CAA C,MAAM,CAAC,CAAC,CAAC,CAAC,WAAW,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC,CAAC,CAAC,CA AC,OAAO,CAAC,KAAK,CAAC,GAAG,EAAC,CAAC,UAAU,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC,KA



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E,aAAa,CAAC;;;;;;;" }

Found

in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.js.map

No license file was found, but licenses were detected in source scan.

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```
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```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\nimport { concat } from './Concat';\nimport
{ expandDims } from './ExpandDims';\nexport function pack(\n args: { inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { axis } =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n { inputs: { input: inputs[0] }, backend, attrs: { dim:
axis }});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n}
```

```
inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must\n have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed to stack must have\n matching dtypes');\n});\n\nconst intermediateTensorInfos: TensorInfo[] = [];\nconst expandedTensors =\ninputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n});\n\nconst result = concat({inputs:\nexpandedTensors, backend, attrs: {axis}});\n\nintermediateTensorInfos.forEach(t =>\nbackend.disposeData(t.dataId));\n\nreturn result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName:\nPack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc\n};\n\n"}\n
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pack.js.map
```

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```
* =====*/
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/clamp_impl.cc
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/non_max_suppression_impl.h
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*
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/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sub.cc
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```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sigmoid_test.cc
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/_FusedMatMul.h
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedDepthwiseConv2D.h
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Exp.cc
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```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/CropAndResize.cc
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/leakyrelu_impl.h
```

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/check_macros.h
```

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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wasm/src/cc/kernels/Mean.cc  
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Square.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedConv2D\_test.cc
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- /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/interpolate\_bilinear\_impl.h
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Add.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Relu6.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ResizeBilinear.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ResizeBilinear\_test.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedBatchNorm.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Conv2D.cc
- \*
- /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Less.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sigmoid.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedDepthwiseConv2D.cc
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/NonMaxSuppressionV5.cc
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/sigmoid\_impl.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FusedDepthwiseConv2D\_test.cc  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/clamp\_impl.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/util\_test.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sigmoid.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Log.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/AvgPool\_test.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/non\_max\_suppression\_impl.cc  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LeakyRelu.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ArgMax.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LessEqual.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/prelu\_impl.h  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FloorDiv.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Relu.cc  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-



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wasm/src/cc/kernels/LeakyRelu.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/ResizeBilinear.h
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/binary.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/ClipByValue_test.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/sigmoid_impl.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/backend.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/_FusedMatMul.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/AvgPool.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/MaxPool.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/RealDiv.cc
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/GreaterEqual.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/DepthwiseConv2dNative.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/src/cc/kernels/Maximum.cc

```

No license file was found, but licenses were detected in source scan.

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{"version":3,"file":"index.js","sources":["../../src/kernels/types.ts","../../src/kernels/_FusedMatMul.ts","../../src/kerne
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ls/AddN.ts","../../src/kernels/Identity.ts","../../src/kernels/Transpose.ts","../../src/kernels/kernel_utils.ts","../../src/kern
els/All.ts","../../src/kernels/Any.ts","../../src/kernels/ArgMax.ts","../../src/kernels/AvgPool.ts","../../src/kernels/Resha
pe.ts","../../src/kernels/BatchMatMul.ts","../../node_modules/@tensorflow/tfjs-backend-
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cpu/dist/kernels/Range_impl.js","../../node_modules/@tensorflow/tfjs-backend-
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rnels/NotEqual.ts","../../src/kernels/OneHot.ts","../../src/kernels/OnesLike.ts","../../src/kernels/Pack.ts","../../src/kerne

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../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts","..
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```

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```

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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n *\n *\n // This enum must align with the enum defined in cc/backend.h.\n export enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n }\n\n // Must match enum in cc/fusable_activations.h.\n export enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu = 6\n }\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
```

```
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```

```
=====\n *\n\n import { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\n import { BackendWasm } from '../backend_wasm';\n import { FusableActivation } from './types';\n\n let wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number, biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\n function setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' // out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {a, b, bias, preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n biasId =
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biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ? 0 : \n\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation = \n\n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw\n new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n ` in the wasm backend.`);\n }\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :\n b.shape[2];\n const batchDim = a.shape[0];\n const out = backend.makeOutput([batchDim, leftDim, rightDim],\n a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may\n * not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\n *import { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n *import\n * { BackendWasm } from '../backend_wasm';\n *import { CppDType } from './types';\n *export function\n * createUnaryKernelConfig(\n * kernelName: string, outType?: DataType): KernelConfig {\n * let wasmFunc: (xId:\n * number, dtype: number, outId: number) => void;\n * function setupFunc(backend: BackendWasm): void {\n * wasmFunc =\n * backend.wasm.cwrap(kernelName, null /* void */, [\n * 'number', // x_id\n * 'number', // dtype\n * 'number', //\n * out_id\n *]);\n * }\n * function kernelFunc(args: { backend: BackendWasm, inputs: UnaryInputs }):\n * TensorInfo\n * {\n * const { backend, inputs: { x } } = args;\n * const xId = backend.dataIdMap.get(x.dataId).id;\n * const out =\n * backend.makeOutput(x.shape, outType || x.dtype);\n * const outId = backend.dataIdMap.get(out.dataId).id;\n * // Short-circuit zero-sized tensors.\n * if (util.sizeFromShape(out.shape) === 0) {\n * return out;\n * }\n * wasmFunc(xId, CppDType[x.dtype], outId);\n * return out;\n * }\n * return { kernelName, backendName: 'wasm',\n * setupFunc, kernelFunc };\n *}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\n *import { Abs, KernelConfig } from '@tensorflow/tfjs-core';\n *import { createUnaryKernelConfig } from\n * './unary_kernel';\n *export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * unless required by applicable law or\n * agreed to in\n * writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
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language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppDType} from './types';\n\nexport function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?: DataType): KernelConfig {\n let wasmFunc: (\n aId: number, aShape: Uint8Array, aShapeLen: number, bId: number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*\n void\n */,\n [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const\n\n outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const\n\n loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =\n bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n
```

```
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```

```
=====\n*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppDType} from './types';\n\nlet wasmFunc: (\n inputIds: Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction
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setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n
'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n
]);\n}\n\nfunction addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} =
args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n // Short-circuit zero-sized tensors.\n
if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:
AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n"/**\n * @license\n
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs:
{x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals =
backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n
return out;\n}\n\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName:
'wasm',\n kernelFunc: identity as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from
'./Identity';\nimport {CppType} from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array,
xShapeLength: number, dtype: CCppType,\n outId: number, perm: Uint8Array, permLength: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /*
void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n
'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n}\n\nexport function transpose(\n args:\n {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}): \n TensorInfo {\n const {inputs,
backend, attrs} = args;\n
 // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory
access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n \n let
permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n
 }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n
shape: reducedShape,\n dtype: inputs.x.dtype\n };\n if (permIsNoOp) {\n const cloned = identity({inputs,
backend});\n cloned.shape = outShape;\n return cloned;\n }\n const out = backend.makeOutput(outShape,
x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =

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backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId,\n
xShapeBytes, x.shape.length,\n
 CppDType[x.dtype], outId, permBytes,\n perm.length);\n return out;\n}\n\nfunction\n
computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new\n
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n
return outShape;\n}\n\nfunction removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]]\n
{\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if\n
(shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n\n
newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j =\n
0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] >\n
newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape,\n
newPerm];\n}\n\nexport const\n
transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose\n
as {} as KernelFunc,\n setupFunc: setup,\n};\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from\n
'../backend_wasm';\nimport\n
{transpose} from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose if necessary.\n *\n * Used\n
by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm\n
backend instance\n */\nexport function permuteAxesAndTranspose(\n x: TensorInfo, axis: number|number[],\n
backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n
inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const\n
originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes =\n
backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if\n
(permutedAxes !== null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i <\n
newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n\n axes =\n
backend_util.getInnerMostAxes(axes.length, xRank);\n\n
 xTransposed =\n transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n\n const xId =\n
backend.dataIdMap.get(x.dataId).id;\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n\n
if (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n\n return {transposed: xTransposed,\n
originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights\n
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations\n
under the License.\n *\n
=====\n
*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport

```

```

{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null
/*void*/, ['number, number, number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs:
AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId
= backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const
inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const
reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc:
all as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny:
(xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number, number']);\n}\n\nfunction any(args:
{backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const
inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const
reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc:
any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n

```

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied. See the License for the specific language governing permissions and  
limitations under the License.

```
=====
\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize: number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null / void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number', // out_id\n]);\n\n function argmax(\n args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as { } as ArgMaxAttrs;\n const { x } = inputs as { } as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n }\n\n export const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as { } as KernelFunc,\n setupFunc: setup\n };
}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License.
```

```
=====
\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null / void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n\n function avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,\n dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n }\n}
```



```

const strideWidth = convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat
!=='channelsLast') {\n
 throw new Error(\n `wasm backend does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n } \n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1],` +\n `got
[${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n } \n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n
 const $shape = util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize ===
util.sizeFromShape($shape),\n () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n
`shape must have the same number of elements.`);\n // Backend needs to track refCount for the dataId for reshape
op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const
reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { }
as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under
the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { reshape } from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number',
// b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n
]);\n}\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend: BackendWasm,\n attrs:
BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const {transposeA,
transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n } \n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const

```









VSb290IjoiIiwic291cmNleyI6WyYuLi8uLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2t1bmQtY3B1L3NyYy9rZXJuZWxzL1NsaWNlLnRzIl0sIm5hbWVzIjpbXSswibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7Ozs7Ozs7R0FIRztBQUVILE9BQU8sRUFBRyxZQUFZLEVBQWICLE1BQU0sRUFBC0MsS0FBSyxQUFFLVBQVUsRUFBBUsSUFBSsxFQUFDLE1BQU0sdUJBQXVCLBNBQUM7QUFHEwS0T0FBTyxQUFDLGDcQUFnQixQUFDLE1BQU0sYUFBYsxDQUFD00FBRTdDLE1BQU0sVUFBVsxTQUFTLENBQ3JCLEIBQW1CLEVBQUUsS0FBZsxFQUFFLEIBQWMsRUFBRsxLQUFILEVBQ3JFLEtBQWU7SUFDAkIsTUFBTsxXQUFXLEdBQUcsVUFBVsxDQUFDLGDcQUFnQixDQUFDLEtBQUssRUFBRsxLQUFLLEVBQUUsSUFBSsxDQUFDLENBQUM7SUFDCeUsTUFBTSxNQUFNLEdBQUcsSUFBSsxDQUFDLGFBBQWEsQ0FBQyxJQUFJLENBQUMsQ0FBQztJQUN4QyxNQUFNLFBBQVEsR0FBRyxJQUFJLENBQUMsY0FBYyxDQUFDLEtBQUssQ0FBQyxDQUFD00IBRTVDLEIBQUksV0FBVyxFQUFFO1FBQ2YsTUFBTSxVQUFVLEdBQUcsVUFBVsxDQUFDLGCQUFPqixDQUFDLEtBQUssRUFBRsxRQUFRLENBQUMsQ0FBQztRQUVqRSxJQUFJLEtBQUssS0FBSyxRQUFRLEVBQUU7WUFDdEIsT0FBUSxJQUFxQixDQUFDLEtBQUssQ0FBQyxVQUFVLEVBQUUsVUFBVsxHQUFHLE1BQU0sQ0FBQyxDQUFD01NBQ3RFO1FBRUQsT0FBUSxJQUFtQixDQUFDLFFBQVEsQ0FBQyxVQUFVLEVBQUUsVUFBVsxHQUFHLE1BQU0sQ0FBQyxDQUFD00tBQ3ZFO0IBRUQsTUFBTSxXQUFXLEdBQUcsS0FBSyxLQUFLFFBQVEsQ0FBQyxDQUFD01FBQ3BDLFIBQVksQ0FBQyxzQkFBc0IsQ0FBQyxJQUFvQixDQUFDLENBQUMsQ0FBQztRQUMzRCxJQUFrQixDQUFD00IBRXZCLE1BQU0sS0FBSyxHQUFHLE1BQU0sQ0FBQyxLQUFLLEVBQUUsS0FBSyxQUFFLFdBQVcsQ0FBQyxDQUFD00IBQ2heLE1BQU0sTUFBTSxHQUFHLE1BQU0sQ0FBQyxJQUFJLEVBQUUsS0FBSyxDQUFDLENBQUM7SUFDBkMsS0FBSyxJQUFJLENBQUMsR0FBRyxDQUFDLEVBQUUsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxJQUFJLEVBQUUsRUFBRsxDQUFDLEVBQUU7UUFDCeMsTUFBTSxNQUFNLEdBQUcsTUFBTSxDQUFDLFBQVUsQ0FBQyxDQUFDLENBQUMsQ0FBQztRQUVwQyxNQUFNLEtBQUssR0FBRyxNQUFNLENBQUMsR0FBRyxDQUFDLENBQUMsR0FBRyxVQUFFLENBQUmsRUFBRsxQUFFLENBQUMsR0FBRyxHQUFHLEtBQUssQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFD01FBQzdELE1BQU0sQ0FBQyxHQUFHLENBQUMsS0FBSyxDQUFDLEdBQUcsQ0FBQyxHQUFHLEtBQUssQ0FBQyxQUFFLEdBQUcsTUFBTSxDQUFDLENBQUM7S0FDNUM7SUFFRCxJQUFJLEtBQUssS0FBSyxRQUFRLEVBQUU7UUFDCeIsT0FBTyxZQUFZLENBQUMsc0JBQXNCLBNBQUMsTUFBTSxDQUFDLE1BQWtCLENBQUMsQ0FBQztLQUN2RTtJQUNELE9BQU8sTUFBTSxDQUFDLE1BQW9CLENBQUM7QUFDckMsQ0FBQztBQUVELE1BQU0sVUFBVsxLQUFLLENBQ2pCLEIBQXVFO0IBRXpFLE1BQU0sRUFBRyxNQUFNLEVBQUUsT0FBTyxQUFFLEtBQUssRUFBRyxHQUFHLEtBQUksQ0FBQztJQUN0QyxNQUFNLEVBQUMsQ0FBQyxQUFDLEdBQUcsTUFBTSxDQUFD00IBQ25CLE1BQU0sRUFBRyxLQUFLLEVBQUUsSUFBSsxFQUFDLEdBQUcsS0FBSyxDQUFD00IBRTVCLGDcQUFnQixDQUFDLENBQUMsRUFBRsxPQUFFLENBQUMsQ0FBQztJQUU3QixNQUFNLENBQUMsTUFBTSxFQUFFLEtBQUssQ0FBQyxHQUFHLEVBQVUsQ0FBQyxNkFBZ0IsQ0FBQyxDQUFDLEVBQUUsS0FBSyxQUFFLEtBQUksQ0FBQyxDQUFD00IBQ3BFLFVBQVUsQ0FBQyxPQkFBaUlsQ0FBQyxDQUFDLEVBQUUsTUFBTSxFQUFFLEtBQUssQ0FBQyxDQUFD00IBRS9DLE1BQU0sSUFBSsxHQUFHLE9BQU8sQ0FBQyxJQUFJLENBQUMsR0FBRyxDQUFDLENBQUMsQ0FBQyxNQUFNLENBQUMsQ0FBQyxNQUFNLENBQUM7SUFDL0MsTUFBTSxPQUFFLEdBQUcsU0FBYyxDQUFDLEtBQUksRUFBRsxNQUFNLEVBQUUsS0FBSyxQUFFLENBQUMsQ0FBQyxLQUFLLEVBQUUsQ0FBQyxDQUFDLEtBQUssQ0FBQyxDQUFD00IBQ2pFLE9BQU8sT0FBTyxDQUFDLGNBQWMsQ0FBQyxLQUFLLEVBQUUsQ0FBQyxDQUFDLEtBQUssRUFBRsxPQUFFLENBQUMsQ0FBQztBQUN6RCxDQUFD00FBRUQsTUFBTSxDQUFDLE1BQU0sV0FBVyxBQVyxHQUFpQjtJQUN2QyxVQUFVLEVBQUUsS0FBSztJQUNqQixXQUFXLEVBQUUsS0FBSztJQUNsQixVQUFVLEVBQUUsS0FBeUI7Q0FDdEMsQ0FBQyIsInNvdXJjZXNDb250ZW50IjpbblI8qKlxuICogQGxpY2Vuc2VcbiAqIENvcHlyaWdodCAyMDIwIEVub2dsZSBMTEMuIEFsbCBSaWdodHMGUmVzZXJ2ZWQuXG4gKiBMaWNlbnNIZCB1bmRlciB0aGUgQXByeXhkaWpY2Vuc2UsIFZlcmluNpb24gMi4wICh0aGUgXCIjMaWNlbnNIXCIpO1xuICogeW91IG1heSBub3QgdXNlIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXR0IHRoZSBMaWNlbnNlIjxuICogWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHRoZSBMaWNlbnNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xjQ0VOU0UtMi4wXG4gKlxuICogVW5sZXNzIjHJlcXVpcmVkiGJ5IGFwcGxpY2FibGUgYmVzIG9yIGFnemVIZCB0byBpb3B3cmlu4W5nLCBzb2Z0d2FyZVxuICogZGlzdHJpYnV0ZWQgdW5kZXIgdGhIExpY2Vuc2UgaXMgZGlzdHJpYnV0ZWQgb24gYW4gXCIjBUyBJU1wiIEJBUE0iTLFxuICogV0IUSE9VVCBQXQVJSQU5USUVVTIE9SIENPTkRjVEIPT1MgT0YgQU5ZI







```

KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs: BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {blockShape, crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const
reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted =
backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\nbackend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\nbackend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\nbackend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result
= slice({\n inputs: {x: xTransposedReshaped},\n backend,\n attrs: {begin: sliceBeginCoords, size:
sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n
backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function
cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n TensorInfo {\n const {inputs:
{x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals =
backendtypedArrayFromHeap(x);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.set(inVals);\n
return out;\n}\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n
kernelFunc: cast as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
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=====
*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n *
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=====

```

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*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
max\n 'number' // out_id\n]);\n\n function clip(args: {\n
 inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n}) {\n const {inputs, backend,
attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return
out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n };
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the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { concatImplCPU } from
'../kernel_utils/shared';\n\nimport { identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nexport function
concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const
$inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return
identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const
innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs:
{x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =
inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,\n inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const
outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const
batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims = 0;\n const innerDims =
$inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims +=
innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>

```

```

backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b <
batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const
innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n }\n return
out;\n}\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'wasm',\n
kernelFunc: concat as {} as KernelFunc;\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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=====
*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number,
padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number, dilationWidth: number,
strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:
Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels
= convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad =
convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new
Error(\n `wasm backend Conv2D does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use
'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as {} as KernelFunc;\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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```
=====\n*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number, filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number, topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n]);\n\n function conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat, dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n inputShape, filter.shape as [number, number, number, number],\n strides, dilations, pad, dimRoundingMode, false /* depthwise */,\n $dataFormat);\n\n const {\n batchSize, filterHeight, filterWidth, inChannels, inHeight, inWidth,\n outChannels, outHeight, outWidth, strideHeight, strideWidth\n } = convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides = util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride = isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n\n return out;\n }\n\n export const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
```

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```
=====\n*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of\n the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
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```

```
=====\n*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,\n TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast }\n from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:\n number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,\n extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):\n void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', //\n imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images\n shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation\n value\n 'number' // out id\n]);\n\n function cropAndResize(args: {\n backend: BackendWasm,\n inputs:\n CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { method, extrapolationValue, cropSize } = attrs;\n const { image, boxes, boxInd } = inputs;\n\n const\n numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const\n outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData =\n backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =\n cast({backend, inputs:\n {x: image}, attrs: {dtype: 'float32'}});\n imagesData = backend.dataIdMap.get(castedData.dataId);\n }\n\n const\n imagesId = imagesData.id;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId =\n backend.dataIdMap.get(boxInd.dataId).id;\n const out = backend.makeOutput(outShape, 'float32');\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const imagesShapeBytes = new Uint8Array(new\n Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes,\n imagesShapeBytes, cropHeight,\n cropWidth,\n InterpolationMethod[method as {}] as keyof typeof\n InterpolationMethod,\n extrapolationValue, outId);\n\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n }\n\n export const cropAndResizeConfig:
```

```

KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
cropAndResize as {} as KernelFunc\n};\n"/**\n * @license\n
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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
 './types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive:
number, reverse: number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number',
// x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n
 'number' // dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm,
attrs: CumsumAttrs});\n\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype === 'float32' || x.dtype ===
'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n // permute required axis
to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n
if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm:
permutation}, backend});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n
const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n }\n return out;\n}\n\nexport const cumsumConfig: KernelConfig
= {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm}
from './backend_wasm';\n\nlet wasmDepthToSpace: (\n xId: number, blockSize: number, channelsLast: number,
xStrides: Uint8Array,\n xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n
outSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n 'number', // xId\n 'number', //
blockSize\n 'number', // channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', //
outputShape\n 'array', // outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n}\n\nexport function

```

```

depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} =
attrs;\n\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ? x.shape[1]
: x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n const inputDepth =
(dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const
outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize * blockSize);\n\n const
outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,
'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast
= dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast, xStridesBytes,
x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n
* limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', //
xId\n 'number', // batchSize\n 'number',
// inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n
'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n
'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n
'number', // outputChannels\n 'number', // outId\n]);\n\nfunction depthwiseConv2d(args: {\n inputs:
DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs: DepthwiseConv2dNativeAttrs\n}) {\n const
{inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides, dilations, pad, dimRoundingMode} =
attrs;\n\n const $dilations = dilations
== null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape,
(filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n
true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =

```

```

convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
DepthwiseConv2dNative does not support
dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n };\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n);\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
* distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n", "/*\n * @license\n
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n
* distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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* distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n
* distributed under the License is distributed on an "AS IS" BASIS,\n

```



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```
=====\n\n*/\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from\n './Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} =\n attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if\n (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return\n reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig:\n KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {\n } as\n KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */
```

```
=====\n\n*/\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nexport function fill(args: {attrs:\n FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out =\n backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as\n number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName:\n 'wasm',\n kernelFunc: fill as {\n } as\n KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed\n to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch:\n number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,\n null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', //\n imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =\n backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch,\n imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch,\n imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:\n KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {\n } as\n KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
```

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```
=====\n*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number'];\n);\n function fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n }\n export const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm\n } as KernelFunc;\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
```

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```
=====
import { backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D } from '@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import { FusibleActivation } from './types';

let
wasmFusedConv2d(xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterId:
number, filterHeight: number, filterWidth: number, biasId: number, padTop: number, padRight: number,
padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth:
number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number,
activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) => void;

function setup(backend: BackendWasm) {
 wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,
 null /* void */, [
 'number', // xId
 'number', // batchSize
 'number', // inputHeight
 'number', // inputWidth
 'number', // filterId
 'number', // filterHeight
 'number', // filterWidth
 'number', // biasId
 'number', // padTop
 'number', // padRight
 'number', // padBottom
 'number', // padLeft
 'number', // isSamePad
 'number', // dilationHeight
 'number', // dilationWidth
 'number', // strideHeight
 'number', // strideWidth
 'number', // inputChannels
 'number', // outputChannels
 'number', // activation
 'number', // preluActivationWeightsId
 'number', // leakyreluAlpha
 'number', // outId
]);
 function fusedConv2d(args: {
 inputs: FusedConv2DInputs,
 backend: BackendWasm,
 attrs: FusedConv2DAttrs
 }) {
 const { inputs, attrs, backend } = args;
 const { x, filter, bias, preluActivationWeights } = inputs;
 const { strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha } = attrs;
 const convInfo = backend_util.computeConv2DInfo(x as Tensor4D).shape,
 (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode);
 const fusedActivation = FusibleActivation[activation as {}] as keyof typeof FusibleActivation;

 if (fusedActivation == null) {
 throw new Error(`${activation} activation not yet supported for FusedConv2D`);
 }
 const xId = backend.dataIdMap.get(x.dataId).id;
 const filterId = backend.dataIdMap.get(filter.dataId).id;
 const outputChannels = convInfo.outChannels;
 let biasId = 0;
 if (bias != null) {
 const biasData = backend.dataIdMap.get(bias.dataId);
 if (biasData.shape.length !== 1) {
 throw new Error(`FusedConv2D only supports rank-1 bias but got` + biasData.rank + `rank ${biasData.shape.length}`);
 }
 if (biasData.shape[0] !== outputChannels) {
 throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not` + biasData.rank + `match the number of output channels (${outputChannels})`);
 }
 biasId = biasData.id;
 }
 const filterHeight = convInfo.filterHeight;
 const filterWidth = convInfo.filterWidth;
 const padTop = convInfo.padInfo.top;
 const padRight = convInfo.padInfo.right;
 const padBottom = convInfo.padInfo.bottom;
 const padLeft = convInfo.padInfo.left;
 const dilationHeight = convInfo.dilationHeight;
 const dilationWidth = convInfo.dilationWidth;
 const strideHeight = convInfo.strideHeight;
 const strideWidth = convInfo.strideWidth;
 const inputChannels = convInfo.inChannels;
 const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
 const batchSize = convInfo.batchSize;
 const inHeight = convInfo.inHeight;
 const inWidth = convInfo.inWidth;
 if (dataFormat !== 'NHWC') {
 throw new Error(`wasm backend FusedConv2D does not support dataFormat: "${dataFormat}". Please use 'NHWC'`);
 }
 const out = backend.makeOutput(convInfo.outShape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;
 wasmFusedConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);
 return
 }
}
```

out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the\n \* \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the\n \* License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or\n \* agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES

OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language\n \* governing permissions and\n \* limitations under the License.\n \*/

```
=====\n*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,\n FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet\n wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:\n number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:\n number, activation: number,\n preluActivationWeightsId:\n number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number',\n // outId\n]);\n\n function fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n }) {\n const { inputs, attrs, backend } = args;\n const { x, filter, bias, preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =\n backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusibleActivation[activation as {\n as key of typeof FusibleActivation\n }];\n if (fusedActivation == null) {\n throw new Error(\n `${activation}\n activation not yet supported for FusedDepthwiseConv2D ` +\n `in the wasm backend.`);\n }\n\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const filterId =\n backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n let biasId = 0;\n if (bias != null) {\n const biasData =\n backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape\n (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels}).`);\n }\n\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =\n convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const\n padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =\n convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =\n convInfo.strideHeight;\n\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad =\n convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight =
```

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convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support dataFormat: ` +\n `${dataFormat}`. Please use\n 'NHWC'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0\n :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId,\n batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,\n isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const\n fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n =====\n\n */\n\nimport { gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-\n core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\nlet\n wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:\n number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', //\n sliceSize\n 'array', // strides\n 'number' // outId\n]);\n\n function gatherNd(args: { backend: BackendWasm,\n inputs: GatherNdInputs }):\n TensorInfo {\n const { backend, inputs } = args;\n const { params, indices } =\n inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,\n indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return\n out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =\n backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new\n Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,\n outId);\n\n return out;\n }\n\n export const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n };
}

", "/**\n * @license\n * Copyright 2019\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you\n may\n not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n */\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,\n TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n './backend_wasm';\nimport { reshape } from './Reshape';\nimport { CppDType } from './types';\n\nlet wasmGather:\n (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:\n number, outStrides:\n
```

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 Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmGather =\n backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number', // outId\n]);\n\n function gatherV2(\n args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs:\n GatherV2Attrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x, indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const parsedAxis =\n util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index =\n indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);\n }\n\n const shapeInfo =\n backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,\n batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,\n shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n],\n backend\n });\n const\n indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:\n {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =\n [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length - 1;\n const\n xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n const indicesData =\n backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const xStridesBytes = new Uint8Array(\n new\n Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new\n Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],\n xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =\n shapeInfo.outputShape;\n return out;\n }\n\n export const gatherV2Config: KernelConfig = {\n kernelName:\n GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n };**\n\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n\n *====*\n *\\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n \\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n \\nconst supportsFullBroadcast = false;\n \\nexport const greaterConfig: KernelConfig =\n \\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n \\n/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n\n *====*\n *\\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\n \\nimport {createBinaryKernelConfig}\n from './binary_kernel';\n \\nconst supportsFullBroadcast = false;\n \\nexport const greaterEqualConfig: KernelConfig =\n \\n
```

createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/\*\n \* @license\n \* Copyright 2019 Google

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;\n\nfunction\n setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n export\n function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }):\n TensorInfo {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n }\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n };\n }\n\n /*\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n
```

```
=====\n*\n\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n /*\n * Copyright\n * 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n
```

```
=====\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n /*\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n
```

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*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/**\n * @license\n *
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Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', //
x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args:
{backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
waswMax(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
* http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n // TF API
supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't
support it because it uses xnnpack which only\n // supports float32.\n //\n // Add the following assert only for the
WASM backend instead of at core op\n // level.\n //\n // TODO: add support for int32 input.\n util.assert(\n
x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n\n
const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
 x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n\n const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support
dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n"/**\n * @license\n
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\"License\");\n * you
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nlet wasmMean: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean = backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n\n export function mean(\n args: { backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs }:\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' }});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n const out = backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n\n const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as { } as KernelFunc\n };*\n @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n }\n }\n}
```

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function min(\n args: { backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs }:\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId)
```

```

{\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const minConfig: KernelConfig
= {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport
const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum,
supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport
{CppType} from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n
symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,
xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', //
mode\n 'number', // outId\n]);\n}\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend:
BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId =
backend.dataIdMap.get(x.dataId).id;\n
const out = backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,

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MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the
\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
\n
\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig = \n
createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
\n
\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n
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\n\"License\");\n * you may not use this file except in compliance with the License.\n
\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\n\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
\n
\n\nimport { BackendWasm } from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`\n * \n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer,
resOffset, 4);\n const pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores =
result[2];\n const pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,
pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
\n *
\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'../backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n

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boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n}\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const {backend, inputs,\n attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor, validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName: NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"

```

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n (boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number, softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n}\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n const { boxes, scores } = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n \n Since we are not using validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n \n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n \n return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const\nnonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License\n * is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the\n * License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n}\n\nfunction
```

```

oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs,
backend, attrs} = args;\n const {indices}
= inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out = backend.makeOutput([...indices.shape,
depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth,
onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n kernelName:
OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc,\n};\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const
onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as
{} as KernelFunc,\n};\n", "/*\n *
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under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {concat} from './Concat';\n\nimport
{expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n
 {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype
= inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape, \n 'All tensors
passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype, \n () => 'All tensors
passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const
expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs:
{dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result =
concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t =>
backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName:
Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc,\n};\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

```

```

=====
*/\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes:
 Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes:
 Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n
'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n
'number', // constantValue\n 'number', // outId\n]);\n\nfunction pad(\n args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n
if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n
// the shape is used to compute output shape to pad.\n return fill(\n
 backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n);\n }\n\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
 outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =
 new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
 padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
 new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
 Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
 CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n\n"/**\n
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copy of the License at\n* http://www.apache.org/licenses/LICENSE-2.0\n* Unless required by applicable
law or agreed to in writing, software\n* distributed under the License is distributed on an "AS IS" BASIS,\n*
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n* See the License for
the specific language governing permissions and\n* limitations under the License.\n*
=====
*/\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n
createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n"/**\n
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copy of the License at\n* http://www.apache.org/licenses/LICENSE-2.0\n* Unless required by applicable
law or agreed to in writing, software\n* distributed under the License is distributed on an "AS IS" BASIS,\n*
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n* See the License for
the specific language governing permissions and\n* limitations under the License.\n*
=====
*/\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n
'number' // out_id\n]);\n\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const
 {inputs, backend} = args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
 const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n
 let castedInput =
 input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n
 }\n }\n}

```



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inputId = backend.dataIdMap.get(castedInput.dataId).id;\n } \n\n const out = backend.makeOutput(x.shape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n\n if
(input.dtype != 'float32') {\n backend.disposeData(castedInput.dataId);\n } \n return out;\n}\n\nexport const
preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n
 setupFunc: setup,\n kernelFunc: prelu as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose }
from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmProd: (\n xId: number, reduceSize:
number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n
]);\n}\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n}): TensorInfo
{\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once
we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =
backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const prodConfig:
KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport
{ rangeImplCPU } from './kernel_utils/shared';\n\nexport const range = (\n args: { backend: BackendWasm, attrs:
RangeAttrs\n}): TensorInfo => {\n const { backend, attrs } = args;\n const { start, stop, step, dtype } =
attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const out = backend.makeOutput([values.length],

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dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n};\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from './Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number', // outId\n]);\n}

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newWidth\n 'number', // alignCorners\n 'number',
 // halfPixelCenters\n 'number' // outId\n]);\n}\n\nfunction resizeBilinear(args: {\n backend: BackendWasm,\ninputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} =
args;\n\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size} = attrs;\n const [newHeight,
newWidth] = size;\n\n const [batch, oldHeight, oldWidth, numChannels] = images.shape;\n const outShape =
[batch, newHeight, newWidth, numChannels];\n\n let xData = backend.dataIdMap.get(images.dataId);\n let
castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs:
{dtype: 'float32'}});\n xData = backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n
}\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n
 xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0,
halfPixelCenters ? 1 : 0, outId);\n\n if (castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n\n
return out;\n}\n\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n", "/*\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
'/Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array,
axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n
'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', // out_shape_length\n
'number' // out_id\n]);\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs, backend: BackendWasm, attrs:
ReverseAttrs}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length
=== 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const
axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may
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applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport

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{BackendWasm} from './backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX:
number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n
'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', //
numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n
'number', // fillLength\n 'number', // outId\n]);\n\n\nexport function rotateWithOffset(args: {\n inputs:
RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n\n const out
= backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021
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may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n\n*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n\n*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n\n*/\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppDType} from

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./types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number',
 // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', //
sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n}\n\nfunction scatterNd(\n
args:\n {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs});\n TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out =
backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const
{sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices,
shape);\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const
updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const
 outId = backend.dataIdMap.get(out.dataId).id;\n wasmScatterNd(\n indicesId, updatesId,
 CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return
out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number,
offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect =
backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n
'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n\n const offset = cRank === 0 || cRank > 1
|| tRank === 1 ?\n 1 : \n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset,
outId);\n return out;\n}\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName:
'wasm',\n kernelFunc: select as {} as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*

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void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\nTensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n}\n\nwasmFunc(xId, outId);\nreturn out;\n}\n\nexport const sigmoidConfig:\n\nKernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid\n} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const\n\nsinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmFunc: (xId: number, outId:\n number,\n\n channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =\n backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', //\n channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: { backend: BackendWasm, inputs:\n SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } = args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,\n logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if\n (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return\n out;\n }\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: softmax\n} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from\n '@tensorflow/tfjs-core';\nimport
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*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n
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Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const squaredDifferenceConfig: KernelConfig
=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n
 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n
args: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs}): \n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n
kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
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*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\nimport { reshape } from
 './Reshape';\nimport { slice } from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
 Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm):
 void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', //
xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n
 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n
]);\n\n \nextport function stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs:
 StridedSliceAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { x } = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape,
 begin, end, strides, beginMask, endMask,
 ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1,
 slice is a no-op plus reshape\n result = reshape({ inputs: { x }, backend, attrs: { shape: finalShape } });\n } else if
 (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is memory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output
 slice), we min(begin, end).\n const sliced = slice({ inputs: { x }, backend, attrs: { begin: $begin, size } });\n result
 =\n reshape({ inputs: { x: sliced }, backend, attrs: { shape: finalShape } });\n backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
 'float32');\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new
 Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new
 Int32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const
 outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =
 new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
 beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n result = reshape({ inputs: { x: out }, backend, attrs: { shape: finalShape } });\n backend.disposeData(out.dataId);\n }\n\n return result;\n }\n\n \nextport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc:
 setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n };*\n\n /**\n * @license\n * Copyright 2019 Google LLC.
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
 =====\n\n *\nimport { KernelConfig, Sub } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
 './binary_kernel';\nconst supportsFullBroadcast = true;\n\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub,
 supportsFullBroadcast);\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport
{ CppDType } from './types';\n\nlet wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number)
=>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null
/*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n
]);\n\nfunction sum(args: { backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n
 // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =
backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport
const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
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*\n\nimport { KernelConfig, Tan } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const
tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
```

```
*\n\nimport { KernelConfig, Tanh } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n"/**\n * @license\n */
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=====\n*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =\n backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //\n x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n\n function tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmTile(\n xId, xShapeBytes,\n x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return out;\n }\n\n export\n const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: tile as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n}
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=====\n*\n\nimport\n{KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK: (\n xId:\n number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted: boolean,\n outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',\n // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export\n const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,\n attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape =\n x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues =\n backend.makeOutput(outputShape, x.dtype);\n const outValuesId =\n backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape,\n 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n\n return [outValues, outIndices];\n };\n\n export\n const topKConfig: KernelConfig = {\n kernelName: TopK,\n
```

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backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as { } as KernelFunc,\n};\n", "/*\n * @license\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:
number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:
number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength:
number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number',
// batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', //
imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //
interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape,
image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imageData =
backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n\n const transformsData =
backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n\n const
interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case
'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n
fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n
 break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n
image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n }\n\nexport const
transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: transform as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {slice} from

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./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs});\nTensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n \n if (axis < 0) {\n axis += value.shape.length;\n }\n \n const numOutputs = value.shape[axis];\n const rank = value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank; i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size}, backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n}\n\n\nexport\nconst unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as\n { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n * or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *

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*/\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from './backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:\nBackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\n\nexport const\nzerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike\nas { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

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=====\n */\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile the\nlibrary. A modular build would replace\n// the contents of this file and import only the kernels that are\nneeded.\n\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}\nfrom './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from\n './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig}\nfrom './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from\n './kernels/ArgMax';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {batchMatMulConfig} from\n './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport\n{castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from\n './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from\n './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport\n{cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig}\nfrom './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport\n{depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from\n './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from\n './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from\n './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from\n './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from

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./kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
{fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
./kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig}
from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport {maximumConfig} from
./kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport {meanConfig} from
./kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
./kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport
{prodConfig} from './kernels/Prod';\nimport {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from
./kernels/RealDiv';\nimport {reluConfig} from './kernels/Relu';\nimport {relu6Config} from
./kernels/Relu6';\nimport {reshapeConfig} from './kernels/Reshape';\nimport {resizeBilinearConfig} from
./kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport {rotateWithOffsetConfig}
from './kernels/RotateWithOffset';\nimport {roundConfig} from './kernels/Round';\nimport {rsqrtConfig} from
./kernels/Rsqrt';\nimport {scatterNdConfig} from './kernels/ScatterNd';\nimport {selectConfig} from
./kernels/Select';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {sinConfig} from
./kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from
./kernels/Softmax';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport {splitVConfig}
from './kernels/SplitV';\nimport {sqrtConfig} from './kernels/Sqrt';\nimport
{squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n

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padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n
reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n\n/**\n * True if threads are supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-
detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n // TODO(annxingyuan):
Enable node support once this is resolved:\n // https://github.com/tensorflow/tfjs/issues/3830\n if
(ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n // Test for transferability of SABs (needed for Firefox)\n
// https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined'
&& document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModuleThreadedSimd) {\n
WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}\nvar Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};\nvar
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});\nvar
moduleOverrides={};\nvar key;for(key in

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Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.\/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\\\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\\\"path\\\").
dirname(scriptDirectory)+\\\"^\"}else{scriptDirectory=__dirname+\\\"^\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\\\"argv\\\"].length>1){thisProgram=process[\\\"argv\\\"][[1].replace(/\\\\\\\\\\\\g,\\\"^\\\")}arguments_=process[\\\"arg
v\\\"].slice(2);process[\\\"on\\\"](\\\"uncaughtException\\\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\\\"on\\\"](\\\"unhandledRejection\\\",abort);quit_=function(status){process[\\\"exit\\\"](status)};Module[\\\"insp
ect\\\"]=function(){return\\\"[Emscripten
Module object]\\\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\\\"worker_threads\\\")}catch(e){console.error(\\\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\\\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\\\"binary\\\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else
if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\"undefined\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\\\"blob:\\\")!=\"=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\\\"^\\")+1)}else{scriptDirectory=\\\"\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.send(null);return

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xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\undefined\){global.performance=require("\perf_hooks\").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram"];if(Module["quit\"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var
Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("\no native wasm
support detected\")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,\Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={\string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string")return
UTF8ToString(ret);if(returnType===\boolean")return Boolean(ret);return ret}var func=getCFunc(ident);var
cArgs=[];var stack=0;if(args){for(var i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else

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if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return
outIdx-startIdx}function stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var
wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var __ATEXIT__=[];var
__ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend

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encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("\Pthread
aborting at \"+(new Error).stack);what+="\";err(what);ABORT=true;EXITSTATUS=1;what="\abort(\"+what+\").
Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-wasm-threaded-
simd.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"})return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\"wasm-instantiate\")}function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0})}};function initPthreadsJS(){PThread.initRuntime();function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)

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} } else { func(callback.arg === undefined ? null : callback.arg) } } } var
ERRNO_CODES = { EPERM: 63, ENOENT: 44, ESRCH: 71, EINTR: 27, EIO: 29, ENXIO: 60, E2BIG: 1, ENOEXEC: 45, E
BADF: 8, ECHILD: 12, EAGAIN: 6, EWOULDBLOCK: 6, ENOMEM: 48, EACCES: 2, EFAULT: 21, ENOTBLK: 105, EB
USY: 10, EEXIST: 20, EXDEV: 75, ENODEV: 43, ENODIR: 54, EISDIR: 31, EINVAL: 28, ENFILE: 41, EMFILE: 33, EN
OTTY: 59, ETXTBSY: 74, EFBIG: 22, ENOSPC: 51, EPIPE: 70, EROFS: 69, EMLINK: 34, EPIPE: 64, EDOM: 18, ERAN
GE: 68, ENOMSG: 49, EIDRM: 24, ECHRNG: 106, EL2NSYNC: 156, EL3HLT: 107, EL3RST: 108, ELNRNG: 109, EUNA
TCH: 110, ENOCSI: 111, EL2HLT: 112, EDEADLK: 16, ENOLCK: 46, EBADE: 113, EBADR: 114, EXFULL: 115, ENOA
NO: 104, EBADRQC: 103, EBADSLT: 102, EDEADLOCK: 16, EBFONT: 101, ENOSTR: 100, ENODATA: 116, ETIME:
117, ENOSR: 118, ENONET: 119, ENOPKG: 120, EREMOTE: 121, ENOLINK: 47, EADV: 122, ESRMNT: 123, ECOMM
: 124, EPROTO: 65, EMULTIHOP: 36, EDOTDOT: 125, EBADMSG: 9, ENOTUNIQU: 126, EBADFD: 127, EREMCHG: 1
28, ELIBACC: 129, ELIBBAD: 130, ELIBSCN: 131, ELIBMAX: 132, ELIBEXEC: 133, ENOSYS: 52, ENOTEMPTY: 55,
ENAMETOOLONG: 37, ELOOP: 32, EOPNOTSUPP: 138, EPFNOSUPPORT: 139, ECONNRESET: 15, ENOBUFS: 42,
EAFNOSUPPORT: 5, EPROTOTYPE: 67, ENOTSOCK: 57, ENOPROTOOPT: 50, ESHUTDOWN: 140, ECONNREFU
SED: 14, EADDRINUSE: 3, ECONNABORTED: 13, ENETUNREACH: 40, ENETDOWN: 38, ETIMEDOUT: 73, EHOS
TDOWN: 142, EHOSTUNREACH: 23, EINPROGRESS: 26, EALREADY: 7, EDESTADDRREQ: 17, EMSGSIZE: 35, E
PROTONOSUPPORT: 66, ESOCKTNOSUPPORT: 137, EADDRNOTAVAIL: 4, ENETRESET: 39, EISCONN: 30, EN
OTCONN: 53, ETOOMANYREFS: 141, EUSERS: 136, EDQUOT: 19, ESTALE: 72, ENOTSUP: 138, ENOMEDIUM: 14
8, EILSEQ: 25, EOVERFLOW: 61, ECANCELED: 11, ENOTRECOVERABLE: 56, EOWNERDEAD: 62, ESTRPIPE: 13
5 }; function
_emsripten_futex_wake(addr, count) { if (addr <= 0 || addr > GROWABLE_HEAP_I8().length || addr & 3 != 0 || count < 0) retu
rn -28; if (count == 0) return 0; if (count >= 2147483647) count = Infinity; var
mainThreadWaitAddress = Atomics.load(GROWABLE_HEAP_I32(), __emsripten_main_thread_futex >> 2); var
mainThreadWoken = 0; if (mainThreadWaitAddress == addr) { var
loadedAddr = Atomics.compareExchange(GROWABLE_HEAP_I32(), __emsripten_main_thread_futex >> 2, mainTh
readWaitAddress, 0); if (loadedAddr == mainThreadWaitAddress) { --count; mainThreadWoken = 1; if (count <= 0) return
1 } } var ret = Atomics.notify(GROWABLE_HEAP_I32(), addr >> 2, count); if (ret >= 0) return
ret + mainThreadWoken; throw "Atomics.notify returned an unexpected value
\" + ret } Module["_emsripten_futex_wake"] = _emsripten_futex_wake; function
killThread(pthread_ptr) { if (ENVIRONMENT_IS_PTHREAD) throw "Internal Error! killThread() can only ever be
called from main application thread!"; if (!pthread_ptr) throw "Internal Error! Null pthread_ptr in
killThread!"; GROWABLE_HEAP_I32()[pthread_ptr + 12 >> 2] = 0; var
pthread = PThread.threads[pthread_ptr]; pthread.worker.terminate(); PThread.freeThreadData(pthread); PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker), 1); pthread.worker.pthread = undefined } functio
n cancelThread(pthread_ptr) { if (ENVIRONMENT_IS_PTHREAD) throw "Internal Error! cancelThread() can only
ever be called from main application thread!"; if (!pthread_ptr) throw "Internal Error! Null pthread_ptr in
cancelThread!"; var
pthread = PThread.threads[pthread_ptr]; pthread.worker.postMessage({ "cmd": "cancel" }) } function
cleanupThread(pthread_ptr) { if (ENVIRONMENT_IS_PTHREAD) throw "Internal Error! cleanupThread() can only
ever be called from main
application thread!"; if (!pthread_ptr) throw "Internal Error! Null pthread_ptr in cleanupThread!"; var
pthread = PThread.threads[pthread_ptr]; if (pthread) { GROWABLE_HEAP_I32()[pthread_ptr + 12 >> 2] = 0; var
worker = pthread.worker; PThread.returnWorkerToPool(worker) } } var
PThread = { unusedWorkers: [], runningWorkers: [], initMainThreadBlock: function() { var pthreadPoolSize = 8; for (var
i = 0; i < pthreadPoolSize; ++i) { PThread.allocateUnusedWorker() } }, initRuntime: function() { var
tb = _malloc(228); for (var
i = 0; i < 228 / 4; ++i) GROWABLE_HEAP_U32()[tb / 4 + i] = 0; GROWABLE_HEAP_I32()[tb + 12 >> 2] = tb; var
headPtr = tb + 152; GROWABLE_HEAP_I32()[headPtr >> 2] = headPtr; var tlsMemory = _malloc(512); for (var
i = 0; i < 128; ++i) GROWABLE_HEAP_U32()[tlsMemory / 4 + i] = 0; Atomics.store(GROWABLE_HEAP_U32(), tb + 100

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>>2, tlsMemory); Atomics.store(GROWABLE_HEAP_U32(), tb+40>>2, tb); __emscripten_thread_init(tb, !ENVIRON
MENT_IS_WORKER, 1); __emscripten_register_main_browser_thread_id(tb); initWorker: function() {}, pthreads: { }, t
hreadExitHandlers: [], setThreadStatus: function() {}, runExitHandlers: function() { while(PThread.threadExitHandlers.l
ength>0) { PThread.threadExitHandlers.pop(); if(ENVIRONMENT_IS_PTHREAD && _pthread_self()) __pthread
_tsd_run_dtors(); runExitHandlersAndDeinitThread: function(tb, exitCode) { Atomics.store(GROWABLE_HEAP_U
32(), tb+56>>2, 1); Atomics.store(GROWABLE_HEAP_U32(), tb+60>>2, 0); PThread.runExitHandlers(); Atomics.stor
e(GROWABLE_HEAP_U32(), tb+4>>2, exitCode); Atomics.store(GROWABLE_HEAP_U32(), tb+0>>2, 1); __emscri
pten_futex_wake(tb+0, 2147483647); __emscripten_thread_init(0, 0, 0); threadExit: function(exitCode) { var
tb = _pthread_self(); if(tb) { PThread.runExitHandlersAndDeinitThread(tb, exitCode); if(ENVIRONMENT_IS_PTHRE
AD) { postMessage({"cmd": "exit"}); }, threadCancel: function() { PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(), -1); postMessage({"cmd": "cancelDone"}); }, terminateAllThreads: function() { for(var t in
PThread.pthreads) { var
pthread = PThread.pthreads[t]; if(pthread && pthread.worker) { PThread.returnWorkerToPool(pthread.worker); } PThre
ad.pthreads = { }; for(var
i = 0; i < PThread.unusedWorkers.length; ++i) { var
worker = PThread.unusedWorkers[i]; worker.terminate(); PThread.unusedWorkers = []; for(var
i = 0; i < PThread.runningWorkers.length; ++i) { var worker = PThread.runningWorkers[i]; var
pthread = worker.pthread; PThread.freeThreadData(pthread); worker.terminate(); PThread.runningWorkers = []; freeTh
readData: function(pthread) { if(!pthread) return; if(pthread.threadInfoStruct) { var
tlsMemory = GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2]; GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2] = 0; _free(tlsMemory); _free(pthread.threadInfoStruct); pthread.threadInfoStruct = 0; if(pthread.
allocatedOwnStack && pthread.stackBase) _free(pthread.stackBase); pthread.stackBase = 0; if(pthread.worker) pthread.
worker.pthread = null }, returnWorkerToPool: function(worker) { PThread.runWithoutMainThreadQueuedCalls(funcio
n) { delete
PThread.pthreads[worker.pthread.threadInfoStruct]; PThread.unusedWorkers.push(worker); PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker), 1); PThread.freeThreadData(worker.pthread); worker.pthread = un
defined; }, runWithoutMainThreadQueuedCalls: function(func) { GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2] = 0; try { func(); } finally { GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2] = 1; }, receiveObjectTransfer: function(data) {}, loadWasmModuleToWorker: function(worker, o
nFinishedLoading) { worker.onmessage = function(e) { var
d = e["data"]; var
cmd = d["cmd"]; if(worker.pthread) PThread.currentProxiedOperationCallerThread = worker.pthread.threadInfoStruct;
if(d["targetThread"] && d["targetThread"] != _pthread_self()) { var
thread = PThread.pthreads[d.targetThread]; if(thread) { thread.worker.postMessage(e.data, d["transferList"]); } else { con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')} PThread.currentProxiedOperationCallerThread = undefined; return } if(cmd === "processQueuedMainThread
Work") { __emscripten_main_thread_process_queued_calls(); } else
if(cmd === "spawnThread") { spawnThread(e.data); } else
if(cmd === "cleanupThread") { cleanupThread(d["thread"]); } else
if(cmd === "killThread") { killThread(d["thread"]); } else
if(cmd === "cancelThread") { cancelThread(d["thread"]); } else
if(cmd === "loaded") { worker.loaded = true; if(onFinishedLoading) onFinishedLoading(worker); if(worker.runPthread)
{ worker.runPthread(); delete worker.runPthread; } } else if(cmd === "print") { out("Thread \" + d["threadId"] + "\":
\" + d["text"]); } else if(cmd === "printErr") { err("Thread \" + d["threadId"] + "\": \" + d["text"]); } else
if(cmd === "alert") { alert("Thread \" + d["threadId"] + "\": \" + d["text"]); } else if(cmd === "exit") { var
detached = worker.pthread && Atomics.load(GROWABLE_HEAP_U32(), worker.pthread.threadInfoStruct+64>>2); if
(detached) { PThread.returnWorkerToPool(worker); } } else

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if(cmd===\exitProcess\"){try{exit(d[\returnCode\])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\setimmediate\"){worker.postMessage(e.data)}else{err(\worker sent an unknown command
\'+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\pthread sent
an error! \'+e.filename+\':\'+e.lineno+\':
\'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\message\",function(data){worker.onmessage({data:d
ata})});worker.on(\error\",function(data){worker.onerror(data)});worker.on(\exit\",function(data){})}worker.post
Message({\"cmd\":\load\",\"urlOrBlob\":Module[\mainScriptUrlOrBlob\]|_scriptDir,\wasmmemory\":wasmmem
ory,\wasmmodule\":wasmmodule}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\tfjs-
backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return
PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now(<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\Assertion failed: \'+UTF8ToString(condition)+\', at:
\'+[filename?UTF8ToString(filename):\unknown filename],line,func?UTF8ToString(func):\unknown
function\')}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\hrtime\]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return
performance.now()-Module[__performance_now_clock_drift\]}]}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\":\processQueuedMainThreadWork\})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\":\processThreadQueue
e\})}else{var pthread=PThread pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return worker.postMessage({\"cmd\":\processThreadQueue\})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\timed-out\")return-
73;if(ret===\not-equal\")return-6;if(ret===\ok\")return 0;throw\Atomics.wait returned an unexpected value
\'+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-

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73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32()),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return
navigator["hardwareConcurrency"]}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);return
ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return
readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J

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SEvents.canPerformEventHandlerRequests(){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){ var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){ var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){ var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){ eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{ var
stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){ targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){ targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){ return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){ target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){ return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){ var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){ GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA

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P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n _emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emscripten_set_current_thread_status(newStatus){}function
_emscripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return
1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault==="undefined"||webGLContextAttributes.enableExtensions

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ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"\\\"){name=name.slice(0,name.lastIndexOf(\"\\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+\"\\\"+j+\"\\\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=[\"default\", \"low-power\", \"high-performance\"];function
_emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\"alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\"depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\"stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)];var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emscripten_webgl_create_context(a0,a1){return _emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iocnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return

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_emsripten_proxy_to_main_thread_js(5,1,fd,iovs,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iovs+i*8>>2];var len=GROWABLE_HEAP_I32()[iovs+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j]);num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg)}})f
unction
spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! spawnThread() can only
ever be called from main application thread!`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw`"Internal
error!";if(!threadParams.pthread_ptr)throw`"Internal error, no pthread
ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={`"cmd\":"run\","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===`"undefined`"){err(`"Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`"pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase-
=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={ stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=`"spawnThread"`;postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=_pthread_self();if(!tb)return;var

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cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\Canceled!\}function
__emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\)}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join
attempted on a null thread pointer!\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err(\PThread
\'+thread+\'' is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()==thread){err(\Main thread
\'+thread+\'' is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\pthread_join attempted on thread
\'+thread+\', which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\Attempted to join thread
\'+thread+\', which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){__emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else
 postMessage(\{\"cmd\":\`cleanupThread\`,`thread\":thread});return 0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)__emscripten_main_thre
ad_process_queued_calls();__emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}function __pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
__sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case
11:case 29:case 47:case 48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case
23:case 24:case 160:case 161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case
165:case 178:case 179:case 49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case
32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case
125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case
70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case
1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return
6;case 73:return 4;case 84:{if(typeof navigator===\`object\`)return navigator[\`hardwareConcurrency\`]||1;return
1}}setErrNo(28);return-1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,__emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_w
rite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
__emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca

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nvas_element_size,\i\":_emscripten_set_current_thread_status,\s\":_emscripten_set_thread_name,\w\":_emscript
en_webgl_create_context,\l\":_fd_close,\n\":_fd_seek,\ng\":_fd_write,\o\":initPthreadsJS,\a\":wasmMemory||Mo
dule[\wasmMemory\],\z\":_pthread_cleanup_pop,\k\":_pthread_cleanup_push,\h\":_pthread_create,\m\":_pthr
ead_join,\t\":_sysconf};var
asm=createWasm();var
__wasm_call_ctors=Module[__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[__wasm
_call_ctors\"]=Module[\asm\"][\B\"]).apply(null,arguments)};var
_init=Module[_init\"]=function(){return(_init=Module[_init\"]=Module[\asm\"][\C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[_init_with_threads_count\"]=Module[\asm\"][\D\"]).apply(null,arguments)};var
_get_threads_count=Module[_get_threads_count\"]=function(){return(_get_threads_count=Module[_get_threads
_count\"]=Module[\asm\"][\E\"]).apply(null,arguments)};var
_register_tensor=Module[_register_tensor\"]=function(){return(_register_tensor=Module[_register_tensor\"]=M
odule[\asm\"][\F\"]).apply(null,arguments)};var
_dispose_data=Module[_dispose_data\"]=function(){return(_dispose_data=Module[_dispose_data\"]=Module[\
asm\"][\G\"]).apply(null,arguments)};var
_dispose=Module[_dispose\"]=function(){return(_dispose=Module[_dispose\"]=Module[\asm\"][\H\"]).apply(
null,arguments)};var
_Abs=Module[_Abs\"]=function(){return(_Abs=Module[_Abs\"]=Module[\asm\"][\J\"]).apply(null,arguments
)};var
_Add=Module[_Add\"]=function(){return(_Add=Module[_Add\"]=Module[\asm\"][\K\"]).apply(null,argumen
ts)};var
_AddN=Module[_AddN\"]=function(){return(_AddN=Module[_AddN\"]=Module[\asm\"][\L\"]).apply(null,ar
guments)};var
_All=Module[_All\"]=function(){return(_All=Module[_All\"]=Module[\asm\"][\M\"]).apply(null,arguments)};
var
_Any=Module[_Any\"]=function(){return(_Any=Module[_Any\"]=Module[\asm\"][\N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[_ArgMax\"]=function(){return(_ArgMax=Module[_ArgMax\"]=Module[\asm\"][\O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[_AvgPool\"]=function(){return(_AvgPool=Module[_AvgPool\"]=Module[\asm\"][\P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[_BatchMatMul\"]=function(){return(_BatchMatMul=Module[_BatchMatMul\"]=Modu
le[\asm\"][\Q\"]).apply(null,arguments)};var
_Ceil=Module[_Ceil\"]=function(){return(_Ceil=Module[_Ceil\"]=Module[\asm\"][\R\"]).apply(null,argument
s)};var
_ClipByValue=Module[_ClipByValue\"]=function(){return(_ClipByValue=Module[_ClipByValue\"]=Module[\
asm\"][\S\"]).apply(null,arguments)};var
_Conv2D=Module[_Conv2D\"]=function(){return(_Conv2D=Module[_Conv2D\"]=Module[\asm\"][\T\"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module[_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[_Conv2DBackpropInput\"]=Module[\asm\"][\U\"]).apply(null,arguments)};var
_Cos=Module[_Cos\"]=function(){return(_Cos=Module[_Cos\"]=Module[\asm\"][\V\"]).apply(null,arguments
)};var
_Cosh=Module[_Cosh\"]=function(){return(_Cosh=Module[_Cosh\"]=Module[\asm\"][\W\"]).apply(null,argu
ments)};var

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_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var

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_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["t
a")]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua")]).apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va")]).apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa
")]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["x
a")]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya")]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za")]).apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][["Aa")]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][["Ba")]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][["Ca")]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"
])}).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea")]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa")]).apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga")]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha")]).apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia")]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja")]).app
ly(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka")]).apply(null,argum
ents)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La")]).apply(null,a
rguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"][["Ma")]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na")]).app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][["Oa")]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa")]).apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa")]).apply(null,arg
uments)};var

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_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra
\"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa\"]).
apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta\"]).ap
ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua\"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va\"]).a
pply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa\"]).apply(null,argume
nts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa\"]).apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][["Ya\"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za\"]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][["_a\"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a\"]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab\"]).apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb\"]).apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb\"]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db\"]).apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb\"]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["f
b\"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["g
b\"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["hb\"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib\"]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb\"]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["kb\"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb\"]).apply(null,arguments)};var
_pthread_self=Module["_pthread_self"]=function(){return(_pthread_self=Module["_pthread_self"]=Module["as
m"][["mb\"]).apply(null,arguments)};var

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__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=function(){return(_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=function(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_do_dispatch_to_thread=Module["_emsripten_do_dispatch_to_thread"]=function(){return(_emsripten_do_dispatch_to_thread=Module["_emsripten_do_dispatch_to_thread"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){return(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_call_on_thread=Module["_emsripten_call_on_thread"]=function(){return(_emsripten_call_on_thread=Module["_emsripten_call_on_thread"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsripten_tls_init"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_thread_init=Module["_emsripten_thread_init"]=function(){return(_emsripten_thread_init=Module["_emsripten_thread_init"]=Module["asm"][\`\\`]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][\`\\`]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][\`\\`]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"][\`\\`]).apply(null,arguments)};var
_emsripten_allow_main_runtime_queued_calls=Module["_emsripten_allow_main_runtime_queued_calls"]=10512;var
_emsripten_main_thread_futex=Module["_emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module["ExitStatus"]=ExitStatus;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with exit(\`\\`+status+\`\\`)";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis

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eResolve(Module);initRuntime();postMessage({"cmd":"\loaded\"});return }preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("\Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"]("\n"),1);doRun(),1})else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"\exitProcess\","returnCode":status});throw new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status));if(Module["preInit"]){if(typeof
Module["preInit"]==="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n return WasmBackendModuleThreadedSimd.ready\n}\n);\n});\nif
(typeof exports === 'object' && typeof module === 'object')\n module.exports =
WasmBackendModuleThreadedSimd;\nelse if (typeof define === 'function' && define['amd'])\n define([],
function() { return WasmBackendModuleThreadedSimd; });\nelse if (typeof exports === 'object')\n
exports["WasmBackendModuleThreadedSimd"] = WasmBackendModuleThreadedSimd;\n,"export const
wasmWorkerContents = 'var Module={};function threadPrintErr(){var
text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function threadAlert(){var
text=Array.prototype.slice.call(arguments).join("
");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]})}}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"])(0,1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["
PThread"].threadExit(result)}catch(ex){if(ex==="Canceled!"){Module["PThread"].threadCancel()}else
if(ex!="unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]){Module["PThread"].threadCancel()}else
if(e.data.target==="setimmediate"){}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]){Module["__emscripten_current_thread_
process_queued_calls"]()}else{err("\worker.js received unknown command
"+e.data.cmd);err(e.data)}}catch(ex){err("\worker.js onmessage() captured an uncaught exception:

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\'+ex);if(ex&&ex.stack)err(ex.stack);throw ex } };if(typeof process===\'object\'&&typeof
process.versions===\'object\'&&typeof process.versions.node===\'string\'){self={location:{href: __filename } };var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\'worker_threads\');global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\'message\',function(data){ onmessage({ data:data })});var
nodeFS=require(\'fs\');var nodeRead=function(filename){return nodeFS.readFileSync(filename,\'utf8\');}function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){ parentPort.postMessage(msg);}if(typeof
performance===\'undefined\'){performance={now:function(){return Date.now()}}};";\nvar
WasmBackendModule = (function() {\n var __scriptDir = typeof document !== \'undefined\' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== \'undefined\')
__scriptDir = __scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\'undefined\'?WasmBackendModule: {} ;var
readyPromiseResolve,readyPromiseReject;Module[\'ready\']=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] } }var arguments_=[];var
thisProgram=\.this.program\';var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\'object\';ENVIRONMENT_IS_WORKER=typeof
importScripts===\'function\';ENVIRONMENT_IS_NODE=typeof process===\'object\'&&typeof
process.versions===\'object\'&&typeof
process.versions.node===\'string\';ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\' ;function
locateFile(path){if(Module[\'locateFile\']){return Module[\'locateFile\'](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\'path\').
dirname(scriptDirectory)+\'/\'}else{scriptDirectory=__dirname+\'/\'}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\'fs\');if(!nodePath)nodePath=require(\'path\');filename=n
odePath[\'normalize\'](filename);return
nodeFS[\'readFileSync\'](filename,binary?null:\'utf8\');}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\'argv\'].length>1){thisProgram=process[\'argv\'][1].replace(/\\/g,\'/\')}arguments_=process[\'arg
v\'].slice(2);process[\'on\'](\\'uncaughtException\',function(ex){if(!(ex instanceof ExitStatus)){throw
ex } });process[\'on\'](\\'unhandledRejection\',abort);quit_=function(status){process[\'exit\'](status)};Module[\'inSp
ect\']=function(){return\[Emscripten Module object\]} }else
if(ENVIRONMENT_IS_SHELL){if(typeof read!==\'undefined\'){read_=function shell_read(f){return
read(f) } }readBinary=function readBinary(f){var data;if(typeof readbuffer===\'function\'){return new
Uint8Array(readbuffer(f))}data=read(f,\'binary\');assert(typeof data===\'object\');return data};if(typeof
scriptArgs!==\'undefined\'){arguments_=scriptArgs}else if(typeof
arguments!==\'undefined\'){arguments_=arguments}if(typeof
quit===\'function\'){quit_=function(status){quit(status) } }if(typeof print!==\'undefined\'){if(typeof
console===\'undefined\')console={ };console.log=print;console.warn=console.error=typeof
printErr!==\'undefined\'?printErr:print } }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof

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document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==""){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.lastIndexOf("/")+1)}else{scriptDirectory=""}{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}setWindowTitle=function(title){document.title=title} }else{ }var out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key in moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverrides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var ret=0;if(str!=null&&str!=undefined&&str!=""){var len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function convertReturnValue(ret){if(returnType=="string")return UTF8ToString(ret);if(returnType=="boolean")return Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var i=0;i<args.length;i++){var converter=toC[argTypes[i]];if(converter){if(stack==0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=0)stackRestore(stack);return ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var numericArgs=argTypes.every(function(type){return type=="number"});var numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[idx++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function UTF8ToString(ptr,maxBytesToRead){return ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var u=str.charCodeAt(i);if(u>=55296&&u<=57343){var u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]

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=u }else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63 }else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63 }else { if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63 } }heap[outIdx]=0;return
outIdx-startIdx }function stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){ HEAP8.set(array,buffer)}function
alignUp(x,multiple){ if(x%multiple>0){ x+=multiple-x%multiple }return x }var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new
Float64Array(buf)}var INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var
__ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){ __wasm_call_ctors() }});function
preRun(){ if(Module["preRun"]){ if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){ a
ddOnPreRun(Module["preRun"].shift()) }callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){ runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){ callRuntimeCallbacks(__ATMAIN__)}function postRun(){ if(Module["postRun"]){ if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){ addOnPostRun(Module["postRun"].shift()) }callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){ __ATPRERUN__.unshift(cb)}function addOnPostRun(cb){ __ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var
dependenciesFulfilled=null;function
addRunDependency(id){ runDependencies++;if(Module["monitorRunDependencies"]){ Module["monitorRunDep
endencies"](runDependencies) } }function removeRunDependency(id){ runDependencies--
;if(Module["monitorRunDependencies"]){ Module["monitorRunDependencies"](runDependencies) }if(runDepend
encies==0){ if(runDependencyWatcher!==null){ clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){ var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback() } }Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){ if(Module["onAbort"]){ Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\n"+what+\n). Build with -s ASSERTIONS=1 for more info.\n";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){ return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,\n";function
isDataURI(filename){ return hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://\n";function
isFileURI(filename){ return hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm\n";if(!isDataURI(wasmBinaryFile)){ wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){ try { if(file===wasmBinaryFile&&wasmBinary){ return new
Uint8Array(wasmBinary) }if(readBinary){ return readBinary(file) }else { throw\n"both async and sync fetching of the
wasm failed\n" } } catch(err){ abort(err) } }function
getBinaryPromise(){ if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){ if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){ return fetch(wasmBinaryFile,{ credentials:\n"same-

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origin\").then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"}return response[\"arrayBuffer\"]().catch(function(){return
getBinary(wasmBinaryFile)}}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject)}})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)}}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\")}addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof
fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-origin\").then(function(response){var
result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(Promise.reject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}function
_abort(){abort()}function
_emscritpen_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscritpen_get_heap_size(){return HEAPU8.length}function
emscritpen_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscritpen_resize_heap(requestedSize){var oldSize=_emscritpen_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscritpen_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iocnt,pnum){var num=0;for(var
i=0;i<iocnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function

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setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case
17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case
154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case
52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case
181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case
50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case
81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case
129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case
42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return
99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return
32767;case
75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case
180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var

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_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][_"A"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][_"B"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][_"C"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["asm"][_"D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][_"E"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][_"F"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["asm"][_"G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["asm"][_"H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["asm"][_"I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["asm"][_"J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["asm"][_"K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["asm"][_"L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["asm"][_"M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["asm"][_"N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["asm"][_"O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["asm"][_"P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["asm"][_"X"]).apply(null,arguments)};var

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_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_"la"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"na"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"qa"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"ra"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"sa"]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"ta"]).apply(null,arguments)};var

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_Reluv6=Module["_Reluv6"]=function(){return(_Reluv6=Module["_Reluv6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra"]]).apply(null,arguments)};var

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__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"]["Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["Ta"]).apply(nu
ll,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["Ua"]).apply(null,argument
s)};var
___errno_location=Module["___errno_location"]=function(){return(___errno_location=Module["___errno_locati
on"]=Module["asm"]["Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["Wa"]).
apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
]["Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ya"
]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1});doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n
return WasmBackendModule.ready\n\n\n);nif (typeof exports === 'object' && typeof module === 'object')\n
module.exports = WasmBackendModule;\nelse if (typeof define === 'function' && define['amd'])\n define([],
function() { return WasmBackendModule; });\nelse if (typeof exports === 'object')\n
exports["WasmBackendModule"] = WasmBackendModule;\n","**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors,
storing encoded bytes. *\n stringBytes?: Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {}
to force non-primitive.\n\nexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data
ids.\n private dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n

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this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n write(values: backend_util.BackendValues, shape:\n number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n numDataIds(): number {\n return\n this.dataIdMap.numDataIds();\n }\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =\n util.now();\n f();\n const kernelMs\n = util.now() - start;\n return {kernelMs};\n }\n move(\n dataId: DataId, values:\n backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id =\n this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n const size = util.sizeFromShape(shape);\n const numBytes = size *\n util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values\n as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n }\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return\n this.readSync(dataId);\n }\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,\n dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\n this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n }\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n floatPrecision():\n 32 {\n return 32;\n }\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n }\n }\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n }\n memory() {\n return {unreliable:\n false};\n }\n }\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this method\n allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated elsewhere (in\n c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape: number[], dtype:\n DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size =\n util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId,\n shape, dtype};\n }\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray\n {\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new\n Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset,\n size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new\n Error(`Unknown dtype ${dtype}`);\n }\n }\n }\n }\n function createInstantiateWasmFunc(path: string) {\n // this

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will be replace by rollup plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-
line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-
origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at
'${path}`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary,
imports).then(output => {\n callback(output.instance, output.module);\n
 });\n });\n });\n return {};\n });\n}\n\n/**\n * Returns the path of the WASM binary.\n * @param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\nfunction getPathToWasmBinary(\n
 simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n
 // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n }\n}\n\n/**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n * NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n */\nexport async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n
 return URL.createObjectURL(blob);\n }\n if (path.endsWith('.wasm')) {\n return
getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix
!= null ? wasmPathPrefix : prefix);\n }\n return prefix + path;\n });\n // Use the instantiateWasm override
when system fetch is not available.\n // Reference:\n // https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7fecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n
 return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double error\n
// messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the server can
serve the `.wasm` file relative to the '+\n 'bundled js file. For more details see
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers;\n
reject({message: rejectMsg});\n });\n let wasm: Promise<BackendWasmModule>;\n // If `wasmPath` has
been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported && wasmPath ==
null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob([\n [var WasmBackendModuleThreadedSimd = `
+\n wasmFactoryThreadedSimd.toString()],\n {type: 'text/javascript'}\n],\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,

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['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType,
[]),\n });\n\n resolve({wasm: module});\n });\n });\n\nfunction typedArrayFromBuffer(\n buffer:
ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new
Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new
Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\nconst
wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-
threaded-simd.wasm'\n] as const ;\n\nconst WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet
wasmPath: string = null;\n\nlet wasmPathPrefix: string = null;\n\nlet wasmFileMap: {[key in WasmBinaryName]?:
string} = {};\n\nlet initAborted = false;\n\nlet customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths`
instead.\n * Sets the path to the `.wasm` file which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n *
for more details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use
platform fetch to download\n * the wasm file, default to false.\n * \n * @doc {heading: 'Environment', namespace:
'wasm'}\n */\n\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and ' +\n ' ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n '
`setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n }\n\n/**\n * Configures the locations of the WASM binaries.\n * \n * ``js\n * setWasmPaths({\n *
'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
``\n * \n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n *
SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n *
full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located
in the same directory, or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional
boolean to use platform fetch to download\n * the wasm file, default to false.\n * \n * @doc {heading:
'Environment', namespace: 'wasm'}\n */\n\nexport function setWasmPaths(\n prefixOrFileMap: string|{[key in
WasmBinaryName]?: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n throw new
Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n ' `setWasmPaths()` before
you call `tf.setBackend()` or ' +\n ' `tf.ready()`);\n }\n \n if (typeof prefixOrFileMap === 'string') {\n
wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n
wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n if (missingPaths.length > 0) {\n throw
new Error(\n `There were no entries found for the following binaries: ` +\n ` ${missingPaths.join(',')}.
Please either call setWasmPaths with a ` +\n ` map providing a path for each binary, or with a string indicating
` +\n ` the directory where all the binaries can be found.`);\n }\n }\n\n customFetch =
usePlatformFetch;\n }\n\n/**\n * Used in unit tests. *\n */\n\nexport function resetWasmPath(): void {\n wasmPath = null;\n
wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted
= false;\n }\n\nlet threadsCount = -1;\n\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will
be used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n * \n * This must be
called before calling `tf.setBackend('wasm')`.\n * \n */\n\nexport function setThreadsCount(numThreads: number) {\n
threadsCount = numThreads;\n }\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * \n * It is set
after the backend is initialized.\n * \n */\n\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1)
{\n throw new Error('WASM backend not initialized.);\n }\n return actualThreadsCount;\n }\n\n/** @license
See the LICENSE file. *\n */\n\n// This code is auto-generated, do not modify this file!\n\nconst version =
'3.11.0';\n\nexport {version};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *

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*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm, init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new BackendWasm(wasm);\n}, WASM_PRIORITY);\n\n], "names":["_FusedMatMul", "util", "Abs", "backend_util", "Add", "AddN", "Identity", "setup", "Transpose", "All", "Any", "wasmFunc", "ArgMax", "AvgPool", "Reshape", "BatchMatMul", "slice_util", "buffer", "sliceImplCPU", "Slice", "BatchToSpaceND", "Cast", "Ceil", "ClipByValue", "concatImplCPU", "Concat", "Conv2D", "Conv2DBackpropInput", "Cos", "Cosh", "CropAndResize", "Cumsum", "DepthToSpace", "DepthwiseConv2dNative", "Elu", "supportsFullBroadcast", "Equal", "Exp", "ExpandDims", "Fill", "FlipLeftRight", "Floor", "FloorDiv", "FusedBatchNorm", "FusedConv2D", "FusedDepthwiseConv2D", "GatherNd", "GatherV2", "Greater", "GreaterEqual", "setupFunc", "LeakyRelu", "Less", "LessEqual", "Log", "LogicalAnd", "Max", "Maximum", "MaxPool", "Mean", "Min", "Minimum", "MirrorPad", "Multiply", "Neg", "NonMaxSuppressionV3", "NonMaxSuppressionV4", "NonMaxSuppressionV5", "kernelFunc", "NotEqual", "OneHot", "OnesLike", "Pack", "PadV2", "Pow", "Prelu", "Prod", "rangeImplCPU", "Range", "RealDiv", "Relu", "Relu6", "ResizeBilinear", "Reverse", "RotateWithOffset", "Round", "Rsqrt", "ScatterNd", "Select", "Sigmoid", "Sin", "Softmax", "SpaceToBatchND", "SplitV", "Sqrt", "Square", "SquaredDifference", "Step", "StridedSlice", "Sub", "Sum", "Tan", "Tanh", "Tile", "TopK", "Transform", "Unpack", "ZerosLike", "registerKernel", "env", "tslib_1.__extends", "DataStorage", "engine", "KernelBackend", "tslib_1.__awaiter", "registerBackend"], "mappings":"::;:;:;:;AAAA:;:;:;:;AAiBA;AACa,IAAY,QAMX;AAND,WAAY,QAAQ;IACIB,6CAAW,CAA;IACX,yCAAS,CAA;IACT,uCAAQ,CAA;IACR,2CAAU,CAA;IACV,iDAaA,CAA;AACf,CAAC,EANW,QAAQ,KAAR,QAAQ,QAMnB;AAED;AACa,IAAY,iBAQX;AARD,WAAY,iBAaIB;IAC3B,6DAAU,CAA;IACV,yDAAQ,CAA;IACR,2DAAS,CAA;IACT,2DAAS,CAA;IACT,mEAaA,CAA;IACb,+DAAW,CAA;IACX,uDAAO,CAA;AACT,CAAC,EARW,iBAaIB,KAAjB,iBAaIB;;AC3B7B;;;AAuBa,IAAI,eAKQ,CAAC;AAEb,SAAS,KAAC,CAAC,CAAoB;IACjC,eAAe,GAAG,OAAO,CAAC,IAAI,CAAC,KAAC,CAACA,qBAAY,EAAE,IAAI,aAAa;QACIE,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,gBAAGb,CAAC,IAIzB;IACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;IAC/B,IAAA,YAAC,EAAE,YAAC,EAAE,kBAAI,EAAE,sDAAsB,CAAW;IAEpD,IAAI,CAAC,CAAC,KAAC,KAAC,SAAS,IAAI,CAAC,CAAC,KAAC,KAAC,SAAS,EAAE;QACID,MAAM,IAAI,KAAC,CACX,6DAA6D,CAAC,CAAC;KACpE;IAEM,IAAA,6BAAU,EAAE,6BAAU,EAAE,6BAAU,EAAE,qCAAc,CAAU;IACnE,IAAM,GAAG,GAAG,AAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;IACf,IAAI,IAAI,IAAI,IAAI,EAAE;QACbB,IAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;QACpD,IAAI,QAAQ,CAAC,KAAC,CAAC,MAAM,KAAC,CAAC,EAAE;YAC/B,MAAM,IAAI,KAAC,CACX,iDAaiD;iBACjD,UAAQ,QAAQ,CAAC,KAAC,CAAC,MAAM,MAAG,CAA,CAAC,CAAC;SACvC;QACD,MAAM,GAAG,QAAQ,CAAC,EAAE,CAAC;KACTb;IACD,IAAM,wBAawB,GAAG,sBAAsB,IAAI,IAAI;QAC3D,CAAC;QACD,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC5D,IAAM,eAAe,GACjB,iBAaIB,C AAC,UAAkD,CAAC,CAAC;IAC1E,IAAI,eAAe,IAAI,IAAI,EAAE;QAC3B,MAAM,IAAI,KAAC,CACR,UAAU,mDAAGD;YAC7D,sBAAsB,CAAC,CAAC;KAC7B;IAED,IAAM,OAAO,GAAG,UAAU,GAAG,CAAC,CAAC,K
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CAAC,CAAC,EAAE,CAAC;IAC/C,IAAI,OAAO,GAAG,GAAG,CAAC;IACIB,IAAI,KAAK,GAAG,CAAC,CAA

C;IAER,IAAA,8CACuC,EADtC,0BAAU,EAAE,cAAI,EAAE,8BAAY,EAAE,0CACM,CAAC;IAE9C,IAAI,aAAa,GAAG,IAAI,CAAC;IACzB,IAAI,kBAaKB,EAAE;QACtB,IAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,G AAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACjE,IAAI,YAAY,KAAK,GAAG,EAAE;;;Y AGxB,KAAK,GAAG,UAAU,CAAC;YACnB,OAAO,GAAG,YAAY,CAAC;YACvB,aAAa,GAAGzE,qBAAY,CA AC,gBAAgB,CACzC,aAAa,CAAC,MAAM,EAAE,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;SAC/C; KACF;IAEDA,qBAAY,CAAC,0BAA0B,CACnC,MAAM,EAAE,aAAa,EAAE,KAAK,CAAC,KAAK,CAAC,MA AM,CAAC,CAAC;IACzC,IAAA,gFACgE,EAD/D,gBAAQ,EAAE,mBACqD,CAAC;IACvE,IAAM,UAAU,GAAG F,aAAI,CAAC,aAAa,CAAC,WAAW,CAAC,CAAC;IAEnD,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC, QAAQ,EAAE,KAAK,CAAC,KAAK,CAAC,CAAC;IACtD,IAAIA,aAAI,CAAC,aAAa,CAAC,KAAK,CAAC,KA AK,CAAC,KAAK,CAAC,EAAE;QACzC,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GA AG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACnD,QAAQ,CAAC,OAAO,EAAE,UAAU,EAAE,QAAQ,CA AC,GAAG,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;KAC3D;IAED,IAAI,kBAaKB,EAAE;;QAEtB,OA AO,CAAC,WAAW,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC;KACxC;IAED,IAAI,QAAQ,EAAE;;QAEZ,IAA M,QAAQ,GAAGE,qBAAY,CAAC,oBAAoB,CAAC,GAAG,CAAC,KAAK,EAAE,YAAY,CAAC,CAAC;QAC5E, GAAG,CAAC,KAAK,GAAG,QAAQ,CAAC;KACtB;IAED,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,U AAU,GAAiB;IACtC,UAAU,EAAEY,E,aAAI;IACbB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAErE,OAAK;IACb B,UAAU,EAAE,IAAwB;CACrC;;ACjGD;;;;;;;AAsBO,IAAM,KAAK,GACd,UAAc,IAA+C;IACvC,IAAA,s BAAO,EAAE,kBAaK,CAAS;IACvB,IAAA,mBAaK,EAAE,iBAaI,EAAE,iBAaI,EAAE,mBAaK,CAAU;IACzC ,IAAM,MAAM,GAAGsE,SAAY,CAAC,KAAK,EAAE,IAAI,EAAE,IAAI,EAAE,KAAK,CAAC,CAAC;IAEtD,IA AM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,MAAM,CAAC,MAAM,CAAC,EAAE,KAAK,CAAC,C AAC;IACvD,IAAM,OAAO,GAAG,OAAO,CAAC,kBAaKB,CAAC,GAAG,CAAC,CAAC;IACbD,OAAO,CAAC, GAAG,CAAC,MAAM,CAAC,CAAC;IACpB,OAAO,GAAG,CAAC;AACb,CAAC,CAAC;AAEC,IAAM,WAAW, GAAiB;IACvC,UAAU,EAAEC,cAAK;IACjB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,KAAyB;CACtC;;A CtCD;::::::::::AAqBA,IAAM3C,uBAAqB,GAAG,IAAI,CAAC;AAC5B,IAAM,aAAa,GACtB,wBAAwB,CAAC 4C,gBAAO,EAAE5C,uBAAqB,CAAC;;ACvB5D;::::::::::;AAmBO,IAAM,UAAU,GAAiB,uBAAuB,CAAC6C,a AAI,CAAC;;ACnBrE;::::::::::;AAmBO,IAAM,WAAW,GAAiB,uBAAuB,CAACC,cAAK,CAAC;;ACnBvE;:::: ;::::::::::AAuBA,IAAI,kBAGsE,CAAC;AAE3E,SAAS1E,OAAK,CAAC,OAAoB;IACjC,kBAaKB,GAAG,OAAO,C AAC,IAAI,CAAC,KAAK,CAAC2E,uBAAc,EAAE,IAAI,WAAW;QACrE,QAAQ;QACR,QAAQ;QACR,QAAQ;Q ACr,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACT,C AAC,CAAC;AACL,CAAC;AAED,SAAS,cAAc,CAAC,IAIvB;IACQ,IAAA,sBAAO,EAAE,oBAAM,EAAE,kBA AK,CAAS;IAE/B,IAAA,sBAAM,CAAW;IACjB,IAAA,iCAAY,EAAE,yCAAgB,EAAE,iBAaI,CAAU;IAC9C,IA AA,mBAAS,EAAE,kBAAQ,CAAS;IAE7B,IAAA,iBAAwD,EAAvD,aAAK,EAAE,iBAAS,EAAE,gBAAQ,EAAE, mBAA2B,CAAC;IAC/D,IAAM,QAAQ,GAAG,CAAC,KAAK,EAAE,SAAS,EAAE,QAAQ,EAAE,WAAW,CAAC ,CAAC;IAE3D,IAAI,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC, CAAC;IACjD,IAAI,UAAU,CAAC;IACf,IAAI,KAAK,CAAC,KAAK,KAAK,SAAS,EAAE;QAC7B,UAAU;YAC N,IAAI,CAAC,EAAC,OAAO,SAAS,EAAE,MAAM,EAAE,EAAC,CAAC,EAAE,MAAM,EAAC,EAAE,KAAK,E AAE,EAAC,KAAK,EAAE,SAAS,EAAC,EAAC,CAAC,CAAC;QACpE,KAAK,GAAG,OAAO,CAAC,SAAS,CA AC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC;KACID;IACD,IAAM,GAAG,GAAG,KAAK,CAAC,EA AE,CAAC;IAErB,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,SAAS,CAAC,CAAC;IACp D,IAAIjF,aAAI,CAAC,aAAa,CAAC,MAAM,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;QAC1C,OAAO,GAAG ,CAAC;KACZ;IACD,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,C AAC,CAAC,EAAE,CAAC;IAEnD,kBAaKB,CACd,GAAG,EAAE,KAAK,EAAE,SAAS,EAAE,QAAQ,EAAE,W AAW,EAAE,SAAS,EAAE,QAAQ,EACjE,YAAY,GAAG,CAAC,GAAG,CAAC,EAAE,gBAAgB,GAAG,CAAC, GAAG,CAAC,EAAE,KAAK,CAAC,CAAC;IAE3D,IAAI,UAAU,IAAI,IAAI,EAAE;QACtB,OAAO,CAAC,WAA W,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC;KACxC;IAED,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAA M,oBAAoB,GAAiB;IACbD,UAAU,EAAEiF,uBAAc;IAC1B,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE3E,OA AK;IACbB,UAAU,EAAE,cAAkC;CAC/C;;ACxFD;::::::::::;AAwBA,IAAI,WAE8C,CAAC;AAEnD,SAASA,O AAK,CAAC,OAAoB;IACjC,WAAW,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC4E,gBAAO,EAAE,IAAI,

EAAE;QAC9C,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;KACT,CAAC, CAAC;AACL,CAAC;SAEe,OAAO,CACnB,IAAwE;IAEnE,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS ;IAC/B,IAAA,YAAC,CAAW;IACZ,IAAA,iBAAI,CAAU;IAErB,IAAM,IAAI,GAAGIF,aAAI,CAAC,cAAc,CAAC ,IAAI,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IAEhD,IAAI,CAAC,CAAC,KAAK,CAAC,MAAM,KAAK,CA AC,EAAE;QACxB,OAAO,QAAQ,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,GAAA,EAAC,EAAE,OAAO,SA AA,EAAC,CAAC,CAAC;KACzC;IAED,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAA K,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACjD,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG, CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,C AAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,IAAM,SAAS,GAAG,IAAI,UAA U,CAAC,IAAI,UAAU,CAAC,IAAI,CAAC,CAAC,MAAM,CAAC,CAAC;IAC9D,IAAM,aAAa,GAAG,IAAI,UA AU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;IAErE,WAAW,CAC P,GAAG,EAAE,SAAS,EAAE,IAAI,CAAC,MAAM,EAAE,aAAa,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,E AAE,KAAK,CAAC,CAAC;IAEvE,IAAM,QAAQ,GACV,OAAO,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EA AE,GAAG,EAAC,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,CAAC,CAAC,KAAK,EAAC,EAAE,OAAO,SAAA ,EAAC,CAAC,CAAC;IAEIE,OAAO,CAAC,WAAW,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC;IAChC,OAAO ,QAAQ,CAAC;AACIB,CAAC;AAEM,IAAM,aAAa,GAAiB;IACzC,UAAU,EAAEKf,gBAAO;IACnB,WAAW,EA AE,MAAM;IACnB,UAAU,EAAE,OAA2B;IACvC,SAAS,EAAE5E,OAAK;CACjB;;AC1ED;;;;;;;AAsBA,IA AI,UAGiE,CAAC;AAEtE,SAASA,OAAK,CAAC,OAAoB;IACjC,UAAU,GAAG,OAAO,CAAC,IAAI,CAAC,KA AK,CAAC6E,yBAAgB,EAAE,IAAI,aAAa;QACjE,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,Q AAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;KACT,CAAC,C AAC;AACL,CAAC;SAEe,gBAAgB,CAAC,IAIhC;IACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;I AC/B,IAAA,oBAAK,CAAW;IACbB,IAAA,uBAAO,EAAE,2BAAS,EAAE,qBAAM,CAAU;IAE3C,IAAM,GAAG ,GAAG,OAAO,CAAC,UAAU,CAAC,KAAK,CAAC,KAAK,EAAE,KAAK,CAAC,KAAK,CAAC,CAAC;IACzD,I AAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,C AAC;IACvD,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,C AAC,EAAE,CAAC;IAE7C,IAAA,gBAA2D,EAA1D,aAAK,EAAE,mBAAW,EAAE,kBAAU,EAAE,mBAA0B,CA AC;IAE5D,IAAA,0EAC0D,EADzD,eAAO,EAAE,eACgD,CAAC;IAEjE,IAAM,WAAW,GAAG,SAAS,KAAK,C AAC,CAAC;IACpC,IAAM,gBAAgB,GAAG,GAAG,CAAC;IAE7B,IAAM,UAAU,GAAG,OAAO,SAAS,KAAK, QAAQ;QAC5C,CAAC,SAAS,EAAE,SAAS,EAAE,SAAS,EAAE,WAAW,GAAG,CAAC,GAAG,gBAAgB,CAAC ,GACjE,SAAS,SAAE,gBAAgB,EAAC,CAAC;IACrC,IAAM,SAAS,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CA AC,UAAU,CAAC,CAAC,MAAM,CAAC,CAAC;IAEpE,UAAU,CACN,OAAO,EAAE,KAAK,EAAE,WAAW,EA AE,UAAU,EAAE,WAAW,EAAE,OAAO,EAAE,OAAO,EACIE,OAAO,EAAE,SAAS,EAAE,UAAU,CAAC,MAA M,EAAE,KAAK,CAAC,CAAC;IACID,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,sBAAsB,GAAiB;IAC ID,UAAU,EAAEA,yBAAgB;IAC5B,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,gBAAoC;IACbD,SAAS,EAA E7E,OAAK;CACjB;;AChFD;;;;;;;AAoBO,IAAM,WAAW,GAAiB,uBAAuB,CAAC8E,cAAK,CAAC;;ACpB vE;;;;;;;AAmBO,IAAM,WAAW,GAAiB,uBAAuB,CAACC,cAAK,CAAC;;ACnBvE;;;;;;;AAuBA,IAA I,aAG0C,CAAC;AAE/C,SAAS/E,OAAK,CAAC,OAAoB;IACjC,aAAa,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK ,CAACgF,kBAAS,EAAE,IAAI,WAAW;QAC3D,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAA S,SAAS,CACd,IAC0E;IAErE,IAAA,sBAAO,EAAE,oBAAM,EAAE,kBAAK,CAAS;IAC/B,IAAA,wBAAO,EAA E,wBAAO,CAAW;IAC3B,IAAA,mBAAK,CAAU;IAEtB,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,KA AK,EAAE,OAAO,CAAC,KAAK,CAAC,CAAC;IACrD,IAAIIf,aAAI,CAAC,aAAa,CAAC,KAAK,CAAC,KAAK, CAAC,EAAE;QACnC,OAAO,GAAG,CAAC;KACZ;IAEK,IAAA,mEACmD,EADID,wBAAS,EAAE,0BAAU,EA AE,wBAAS,EAAE,oBAAO,EAAE,0BACO,CAAC;IAE1D,IAAM,WAAW,GAAG,OAAO,CAAC,SAAS,CAAC,G AAG,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC;IACID,IAAM,SAAS,GAAG,WAAW,CAAC,EAAE,CAAC;I AEjC,IAAM,WAAW,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC;I ACID,IAAM,SAAS,GAAG,WAAW,CAAC,EAAE,CAAC;IAEjC,IAAM,YAAY,GAAG,IAAI,UAAU,CAAC,IAA I,UAAU,CAAC,OAAO,CAAC,CAAC,MAAM,CAAC,CAAC;IAEpE,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,

CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IACnD,aAAa,CACT,SAAS,EAAE,SAAS,EAAE,QAAQ,CAAC,OAAO,CAAC,KAAK,CAAC,EAAE,SAAS,EAAE,UAAU,EACpE,SAAS,EAAE,YAAY,EAAE,UAAU,EAAE,KAAK,CAAC,CAAC;IAEhD,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,eAAe,GAAiB;IAC3C,UAAU,EAAEsF,kBAAS;IACrB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAEhF,OAAK;IACbB,UAAU,EAAE,SAA6B;CAC1C;;AC/ED;,,,,,,,,,,,,,AAqBA,IAAI,UAESb,CAAC;AAE3B,SAASA,OAAK,CAAC,OAAoB;IACjC,UAAU,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,EAAE;QACbD,QA AQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAA S,MAAM,CAAC,IAAKD;IACzD,IAAA,oBAAM,EAAE,sBAAO,CAAS;IACxB,IAAA,4BAAS,EAAE,YAAC,EA AE,YAAC,CAAW;IAEjC,IAAM,WAAW,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,SAAS,CAAC,MA AM,CAAC,CAAC,EAAE,CAAC;IAC/D,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAA C,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG, CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,C AAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACjD,IAAM,KAAK,GAAG,OAAO,CA AC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,IAAM,KAAK,GAA G,SAAS,CAAC,KAAK,CAAC,MAAM,CAAC;IACrC,IAAM,KAAK,GAAG,CAAC,CAAC,KAAK,CAAC,MAA M,CAAC;IAE7B,IAAM,MAAM,GAAG,KAAK,KAAK,CAAC,IAAI,KAAK,GAAG,CAAC,IAAI,KAAK,KAAK, CAAC;QACID,CAAC;QACDN,aAAI,CAAC,aAAa,CAAC,CAAC,CAAC,KAAK,CAAC,KAAK,CAAC,CAAC,C AAC,CAAC,CAAC;IAEzC,UAAU,CAAC,WAAW,EAAE,GAAG,EAAE,GAAG,EAAE,MAAM,EAAE,KAAK,C AAC,CAAC;IACjD,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,YAAY,GAAiB;IACxC,UAAU,EAAEuF, eAAM;IACIB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,MAA0B;IACtC,SAAS,EAAEjF,OAAK;CACjB;;AC 7DD;,,,,,,,,,,,,,AAqBA,IAAI,UAA8C,CAAC;AAEnD,SAASJ,OAAK,CAAC,OAAoB;IACjCI,UAAQ,GAAG,OA AO,CAAC,IAAI,CAAC,KAAK,CAAC8E,gBAAO,EAAE,IAAI,aAAa,CAAC,QAAQ,EAAE,QAAQ,CAAC,CAA C,CAAC;AChF,CAAC;AAED,SAAS,OAAO,CAAC,IAAmD;IAE3D,IAAA,sBAAO,EAAW,iBAAC,CAAU;IAC pC,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAA E,CAAC;IAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC, KAAK,CAAC,CAAC;IACjD,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,M AAM,CAAC,CAAC,EAAE,CAAC;;IAGnD,IAAIxF,aAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KA AK,CAAC,EAAE;QACvC,OAAO,GAAG,CAAC;KACZ;IAEDU,UAAQ,CAAC,GAAG,EAAE,KAAK,CAAC,CA AC;IACrB,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,aAAa,GAAiB;IACzC,UAAU,EAAE,SAAS;IACrB ,WAAW,EAAE,MAAM;IACnB,SAAS,EAAEjF,OAAK;IACbB,UAAU,EAAE,OAA2B;CACxC;;AChDD;,,,,,,,,,,,,, ;AAmBO,IAAM,SAAS,GAAiB,uBAAuB,CAACmF,YAAG,CAAC;;ACnBnE;,,,,,,,,,,,,,AAqBA,IAAI/E,UACI,C AAC;AAET,SAASJ,OAAK,CAAC,OAAoB;IACjCI,UAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACgF, gBAAO,EAAE,IAAI,aAAa;QACtD,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;A ACL,CAAC;AAED,SAAS,OAAO,CACZ,IAAwE;IAEnE,IAAA,sBAAO,EAAW,2BAAM,EAAW,oBAAG,CAAU; IACvD,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC, EAAE,CAAC;IACpD,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,MAAM,CAAC,KAAK,EAAE,MAAM, CAAC,KAAK,CAAC,CAAC;IAC3D,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,C AAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,IAAM,QAAQ,GAAG,MAAM,CAAC,KAAK,CAAC,GAAG,C AAC,CAAC;IACnC,IAAM,KAAK,GAAG1F,aAAI,CAAC,aAAa,CAAC,MAAM,CAAC,KAAK,CAAC,GAAG,Q AAQ,CAAC;;IAG1D,IAAIA,aAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;QAC vC,OAAO,GAAG,CAAC;KACZ;IAEDU,UAAQ,CAAC,GAAG,EAAE,KAAK,EAAE,QAAQ,EAAE,KAAK,CAA C,CAAC;IACtC,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,aAAa,GAAiB;IACzC,UAAU,EAAEgF,gBA AO;IACnB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAEpF,OAAK;IACbB,UAAU,EAAE,OAA2B;CACxC;;AC1 DD;,,,,,,,,,,,,,AAyBA,SAAS,cAAc,CAAC,IAIvB;IACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;I AC/B,IAAA,YAAC,CAAW;IACZ,IAAA,6BAAU,EAAE,yBAAQ,CAAU;IAErC,IAAM,IAAI,GAAGN,aAAI,CA AC,aAAa,CAAC,UAAU,CAAC,CAAC;IAE5C,IAAM,gBAAgB,GAA4B,CAAC,CAAC,CAAC,EAAE,CAAC,CA AC,CAAC,CAAC;IAC3D,gBAAgB,CAAC,IAAI,OAArB,gBAAgB,EAAU,QAAoC,EAAE;IAEhE,KAAK,IAAI,C AAC,GAAG,CAAC,GAAG,UAAU,CAAC,MAAM,EAAE,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,MAAM,E



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Ac,CACN;IAEJ,IAAA,+HAY8B,EAXIC,sCAAgB,EACbB,0BAAU,EACV,0BAAU,EACV,wBAAS,EACT,gCAA  
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No license file was found, but licenses were detected in source scan.

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http://www.apache.org/licenses/LICENSE-2.0\n
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the License.\n *
=====\n *\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from '../backend_wasm';\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend:
BackendWasm }) {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\nexport const
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as { } as KernelFunc,\n};\n"}}

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```
=====\n *\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n const { pSelectedIndices, selectedSize,
```

```

pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores
for V4, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize],
'int32', pSelectedIndices);\n\n const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n
return [selectedIndicesTensor, validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config:
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kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc,\n};\n}}

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```

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```
=====
import { backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D } from
 '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
let wasmConv2d: (xId:
 number, batchSize: number, inputHeight: number, inputWidth: number, filterId: number, filterHeight: number,
 filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad:
 number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number,
 inputChannels: number, outputChannels: number, outId: number) => void;
function setup(backend:
 BackendWasm) {
 wasmConv2d = backend.wasm.cwrap(Conv2D,
 null /* void */, [
 'number', // xId
 'number', // batchSize
 'number', // inputHeight
 'number', // inputWidth
 'number', // filterId
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 'number', // filterWidth
 'number', // padTop
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 'number', // dilationHeight
 'number', // dilationWidth
 'number', // strideHeight
 'number', // strideWidth
 'number', // inputChannels
 'number', // outputChannels
 'number', // outId
]);
 function conv2d(
 args: { inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs }) {
 const { inputs, attrs, backend } = args;
 const { x, filter } = inputs;
 const xId =
 backend.dataIdMap.get(x.dataId).id;
 const filterId = backend.dataIdMap.get(filter.dataId).id;
 const { strides,
 dilations, pad, dimRoundingMode, dataFormat } = attrs;
 const $dataFormat =
 backend_util.convertConv2DDataFormat(dataFormat);
 const convInfo = backend_util.computeConv2DInfo(
 (x as Tensor4D).shape, (filter as Tensor4D).shape,
 strides, dilations, pad, dimRoundingMode, false, $dataFormat);
 const filterHeight =
 convInfo.filterHeight;
 const filterWidth = convInfo.filterWidth;
 const padTop = convInfo.padInfo.top;
 const padRight = convInfo.padInfo.right;
 const padBottom = convInfo.padInfo.bottom;
 const padLeft =
 convInfo.padInfo.left;
 const dilationHeight = convInfo.dilationHeight;
 const dilationWidth =
 convInfo.dilationWidth;
 const strideHeight = convInfo.strideHeight;
 const strideWidth =
 convInfo.strideWidth;
 const inputChannels = convInfo.inChannels;
 const outputChannels =
 convInfo.outChannels;
 const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
 if
 (convInfo.dataFormat !== 'channelsLast') {
 throw new Error(
 `wasm backend Conv2D does not support
 dataFormat: ` +
 `${convInfo.dataFormat}`. Please
 use 'channelsLast'.`);
 }
 const out = backend.makeOutput(convInfo.outShape, 'float32');
 const outId =
 backend.dataIdMap.get(out.dataId).id;
 wasmConv2d(
 xId, x.shape[0], x.shape[1], x.shape[2], filterId,
 filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,
 dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels,
 outputChannels, outId);
 return out;
 }
 export
 const conv2DConfig: KernelConfig = {
 kernelName: Conv2D,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: conv2d as { } as KernelFunc;
 };
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2D.js.map

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```
=====\n*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nlet
wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:
{backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\npermuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n const
inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const
reduceSize
= util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
```

setup,\n kernelFunc: all as { } as KernelFunc\n};\n"]}

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/All.js.map

No license file was found, but licenses were detected in source scan.

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express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under  
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```
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from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {sliceImplCPU} from
 './kernel_utils/shared';\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);\n\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const xStrides =
util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n);\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return
out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n }
else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n }
else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number, number, number,
number],\n size_ as [number, number, number, number]);\n }
else {\n const res =\n sliceImplCPU(xVals,
```





,CAAC,CAAC,CAAC,EAAE,QAAQ,EACzD,aAAa,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAC,CAAC,CAAC,C  
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ntent":["/\*\*\n

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specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util }
from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from
 './types';\nimport { transpose } from './Transpose';\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number, finalDim: number, outId: number, dtype: CppDType) => void;\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' // dtype\n]);\n}\nexport function cumsum(\n args: { inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs }):\nTensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { axis, exclusive, reverse } = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype === 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the
WASM backend`);\n // permute required axis to inner most axis\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({ inputs: { x }, attrs: { perm: permutation }, backend});\n }\n const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n // transpose data back if permuted\n let out = permutedOut;\n if (permutation !== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n { inputs: { x: permutedOut }, attrs: { perm: undoPermutation }, backend});\n }\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n}\nreturn
out;\n}\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as KernelFunc\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.js.map

No license file was found, but licenses were detected in source scan.

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions
and\n * limitations under the License.\n *
=====
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.js.map

No license file was found, but licenses were detected in source scan.

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```

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```
=====\n
*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from
'/types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //
sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n
'number' // outId\n]);\n\n function scatterNd(\n args:\n {backend: BackendWasm, inputs:
ScatterNdInputs, attrs: ScatterNdAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices,
updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if
(util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides,
outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype],
sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n }\n\n export const
scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: scatterNd as {} as KernelFunc\n };
}]]
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.js.map

No license file was found, but licenses were detected in source scan.

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```
* =====\n*\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)\n=> void;\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n const {interpolation, fillMode, fillValue, outputShape} = attrs;\n\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as [number, number, number, number];\n const strides =\n new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out =\n backend.makeOutput(outShape, image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n }\n\n export const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:\n transform as {} as KernelFunc\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

wasm/dist/kernels/Transform.js.map

No license file was found, but licenses were detected in source scan.

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=====\n *\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);"]}]
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Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.js.map

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=====\n *\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm }
```

```

from './backend_wasm';\n\nlet wasmClip: (xId: number, min: number, max: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void
*/, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n}\n\nfunction
clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n}) {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return
out;\n}\n\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc:
(xId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: {backend:
BackendWasm, inputs: SigmoidInputs}): TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n return out;\n}\n\n\nexport const sigmoidConfig:
KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid
as {} as KernelFunc\n};\n"}

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 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a  
 copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable  
 law or agreed to in writing, software\n \* distributed under the License is distributed on an  
 \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*  
=====\n \*\nimport './flags\_wasm';\nimport { backend\_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,  
engine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasmModule,

```

WasmFactoryConfig } from './wasm-out/tfjs-backend-wasm';\nimport { BackendWasmThreadedSimdModule } from
 './wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport { wasmWorkerContents } from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype:
 DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?:
 Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-primitive.\n\nexport class
BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n constructor(public wasm:
 BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n write(values: backend_util.BackendValues, shape:
 number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n numDataIds(): number {\n return
 this.dataIdMap.numDataIds();\n }\n async time(f: () => void): Promise<BackendTimingInfo>
 {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount:
 number): void {\n const id = this.dataIdNextNumber++; \n if (dtype === 'string') {\n const stringBytes =
 values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype,
 memoryOffset: null, refCount});\n return;\n }\n const size = util.sizeFromShape(shape);\n const
 numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size,
 memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values
 as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,\n numBytes),\n memoryOffset);\n }\n }\n async read(dataId: DataId):
 Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n readSync(dataId: DataId):
 backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
 this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *
 util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n /**\n * Dispose the
 memory if the dataId has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param
 dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId,
 force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n /** Return
 refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n floatPrecision(): 32 {\n return 32;\n }\n // Returns the memory offset of a tensor. Useful for
 debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return
 this.dataIdMap.get(dataId).memoryOffset;\n }\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in
 this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm
 = null;\n }\n memory() {\n return {unreliable: false};\n }\n /**\n * Make a tensor info for the output of an
 op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer where that memory
 lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let
 dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n

```

```

const id = this.dataIdNextNumber++;
dataId = {id};
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});
const size = util.sizeFromShape(shape);
this.wasm.tfjs.registerTensor(id, size, memoryOffset);
}
return {dataId, shape, dtype};
}
typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):
backend_util.TypedArray {
const buffer = this.wasm.HEAPU8.buffer;
const {memoryOffset} = this.dataIdMap.get(dataId);
const size = util.sizeFromShape(shape);
switch (dtype) {
case 'float32':
return new Float32Array(buffer, memoryOffset, size);
case 'int32':
return new Int32Array(buffer, memoryOffset, size);
case 'bool':
return new Uint8Array(buffer, memoryOffset, size);
default:
throw new Error(`Unknown dtype ${dtype}`);
}
}
}
function createInstantiateWasmFunc(path: string) {
// this will be replaced by rollup plugin patchWechatWebAssembly in miniprogram's output.
// tslint:disable-next-line:no-any
return (imports: any, callback: any) => {
util.fetch(path, {credentials: 'same-origin'}).then((response) => {
if (!response['ok']) {
imports.env.a(`failed to load wasm binary file at '${path}'`);
}
response.arrayBuffer().then(binary => {
WebAssembly.instantiate(binary, imports).then(output => {
callback(output.instance, output.module);
});
});
return {};
});
}
}
Returns the path of the WASM binary.
@param simdSupported whether SIMD is supported
@param threadsSupported whether multithreading is supported
@param wasmModuleFolder the directory containing the WASM binaries.
function getPathToWasmBinary(
simdSupported: boolean, threadsSupported: boolean,
wasmModuleFolder: string) {
if (wasmPath != null) {
// If wasmPath is defined, the user has supplied a full path to the vanilla .wasm binary.
return wasmPath;
}
let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';
if (simdSupported && threadsSupported) {
path = 'tfjs-backend-wasm-threaded-simd.wasm';
} else if (simdSupported) {
path = 'tfjs-backend-wasm-simd.wasm';
}
if (wasmFileMap != null) {
if (wasmFileMap[path] != null) {
return wasmFileMap[path];
}
}
return wasmModuleFolder + path;
}
}
Initializes the wasm module and creates the js <-> wasm bridge.
NOTE: We wrap the wasm module in an object with property 'wasm' instead of returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested in Chrome 76).
export async function init(): Promise<{wasm: BackendWasmModule}> {
const [simdSupported, threadsSupported] = await Promise.all([
env().getAsync('WASM_HAS_SIMD_SUPPORT'),
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')
]);
return new Promise((resolve, reject) => {
const factoryConfig: WasmFactoryConfig = {};
/**
 * This function overrides the Emscripten module locateFile utility.
 * @param path The relative path to the file that needs to be loaded.
 * @param prefix The path to the main JavaScript file's directory.
 */
factoryConfig.locateFile = (path, prefix) => {
if (path.endsWith('.worker.js')) {
const response = wasmWorkerContents;
const blob = new Blob([response], {type: 'application/javascript'});
return URL.createObjectURL(blob);
}
if (path.endsWith('.wasm')) {
return getPathToWasmBinary(
simdSupported as boolean, threadsSupported as boolean,
wasmPathPrefix != null ? wasmPathPrefix : prefix);
}
return prefix + path;
};
// Use the instantiateWasm override when system fetch is not available.
// Reference: https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170
if (customFetch) {
factoryConfig.instantiateWasm = createInstantiateWasmFunc(
getPathToWasmBinary(
simdSupported as boolean, threadsSupported as boolean,
wasmPathPrefix != null ? wasmPathPrefix : ''));
}
let initialized = false;
factoryConfig.onAbort = () => {
if (initialized) {
// Emscripten already called console.warn so no need to double log.
return;
}
if (initAborted) {
// Emscripten calls `onAbort` twice, resulting in double error messages.
return;
}
initAborted = true;
const rejectMsg = `Make sure the server can serve the `.wasm` file relative to the ' + 'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';
reject({message: rejectMsg});
};
let wasm: Promise<BackendWasmModule>;
// If `wasmPath` has been defined we must initialize the vanilla module.
if

```

```

(threadSupported && simdSupported && wasmPath == null) {
 factoryConfig.mainScriptUrlOrBlob = new
 Blob([var WasmBackendModuleThreadedSimd = ` +
 wasmFactoryThreadedSimd.toString()],
 {type: 'text/javascript'});
 wasm = wasmFactoryThreadedSimd(factoryConfig);
} else
{
 // The wasmFactory works for both vanilla and SIMD binaries.
 wasm = wasmFactory(factoryConfig);
}

// The WASM module has been successfully created by the factory.
// Any error will be caught by the
onAbort callback defined above.
wasm.then((module) => {
 initialized = true;
 initAborted = false;

 const voidReturnType: string = null;
 // Using the tfjs namespace to avoid conflict with emscripten's API.
 module.tfjs = {
 init: module.cwrap('init', null, []),
 initWithThreadsCount:
 module.cwrap('init_with_threads_count', null, ['number']),
 getThreadsCount:
 module.cwrap('get_threads_count', 'number', []),
 registerTensor: module.cwrap(
 'register_tensor',
 null,
 [
 'number', // id
 'number', // size
 'number', // memoryOffset
]
),
 disposeData: module.cwrap('dispose_data', voidReturnType,
 ['number']),
 dispose: module.cwrap('dispose', voidReturnType, []),
 };

 resolve({
 wasm:
 module,
 });
});

function typedArrayFromBuffer(
 buffer: ArrayBuffer, dtype: DataType):
 backend_util.TypedArray {
 switch (dtype) {
 case 'float32':
 return new Float32Array(buffer);
 case 'int32':
 return new Int32Array(buffer);
 case 'bool':
 return new Uint8Array(buffer);
 default:
 throw new Error(`Unknown dtype ${dtype}`);
 }
}

const wasmBinaryNames = [
 'tfjs-backend-wasm.wasm',
 'tfjs-backend-wasm-simd.wasm',
 'tfjs-backend-wasm-threaded-simd.wasm'
] as const;
type WasmBinaryName = typeof wasmBinaryNames[number];
let wasmPath: string = null;
let wasmPathPrefix:
string = null;
let wasmFileMap: {
[key in WasmBinaryName]?: string
} = {};
let initAborted = false;
let customFetch = false;

/**
 * @deprecated Use `setWasmPaths` instead.
 * Sets the path to the `.wasm` file
which will be fetched
when the wasm backend is initialized.
See https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
for more details.
@param path wasm file path or url
@param usePlatformFetch optional boolean to use platform fetch to download
the wasm file, default to false.
*/
@doc {
 heading: 'Environment',
 namespace: 'wasm'
}
export function setWasmPath(
 path: string,
 usePlatformFetch = false): void {
 deprecationWarn(
 'setWasmPath has been deprecated in favor of
 setWasmPaths and ' +
 ' will be removed in a future release.
 ');
 if (initAborted) {
 throw new Error(
 'The WASM backend was already initialized.
 Make sure you call ' +
 `setWasmPath()` before you call
 `tf.setBackend()` or `tf.ready()`
);
 }
 wasmPath = path;
 customFetch = usePlatformFetch;
}

/**
 * Configures the locations of the WASM binaries.
 * setWasmPaths({
 * 'tfjs-backend-wasm.wasm':
 * 'renamed.wasm',
 * 'tfjs-backend-wasm-simd.wasm':
 * 'renamed-simd.wasm',
 * 'tfjs-backend-wasm-threaded-simd.wasm':
 * 'renamed-threaded-simd.wasm'
 * });
 * tf.setBackend('wasm');
 *
 * @param prefixOrFileMap This can be either
a string or object:
 * - (string) The path to the directory where the WASM binaries are located.
Note that this
prefix will be used to load each binary (vanilla, SIMD-enabled,
threading-enabled, etc.).
 * - (object)
Mapping from names of WASM binaries to custom full paths
specifying the locations of those binaries. This
is useful if your WASM binaries are not all located in the
same directory, or if your WASM binaries
have been renamed.
 * @param usePlatformFetch optional boolean to use platform
fetch to download the
wasm file, default to false.
*/
@doc {
 heading: 'Environment',
 namespace: 'wasm'
}
export function
setWasmPaths(
 prefixOrFileMap: string | {
[key in WasmBinaryName]?: string
},
 usePlatformFetch
= false): void {
 if (initAborted) {
 throw new Error(
 'The WASM backend was already initialized.
 Make sure you call ' +
 `setWasmPaths()` before you call
 `tf.setBackend()` or ' +
 `tf.ready()`
);
 }
 if (
 typeof prefixOrFileMap === 'string'
) {
 wasmPathPrefix = prefixOrFileMap;
 } else {
 wasmFileMap =
 prefixOrFileMap;
 const missingPaths =
 wasmBinaryNames.filter(
 name => wasmFileMap[name] ==
 null
);
 if (missingPaths.length > 0) {
 throw new Error(
 `There were no entries found for the
 following binaries: ` +
 `${missingPaths.join(',')}.
 Please either call setWasmPaths with a
 map
 providing a path for each binary,
 or with a string indicating
 the directory where all the binaries can be

```

```

found.);
}
}
customFetch = usePlatformFetch;
resetWasmPath(): void {
 wasmPath = null;
 wasmPathPrefix = null;
 wasmFileMap = {};
 customFetch = false;
 initAborted = false;
 let threadsCount = -1;
 actualThreadsCount = -1;
 * Sets the number of threads that will be used by XNNPACK to create
 threadpool (default to the number of logical CPU cores).
 * This must be called before calling
 `tf.setBackend('wasm')`.
 * export function setThreadsCount(numThreads: number) {
 threadsCount = numThreads;
 }
 * Gets the actual threads count that is used by XNNPACK.
 * It is set after the backend is intialized.
 * export function getThreadsCount(): number {
 if (actualThreadsCount === -1) {
 throw new Error(`WASM backend not initialized.`);
 }
 return actualThreadsCount;
 }
}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.js.map

```

No license file was found, but licenses were detected in source scan.

```

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```

```

=====
* import { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
 '@tensorflow/tfjs-core';
* import { BackendWasm } from '../backend_wasm';
* import { slice } from
 './Slice';
* function unpack(
 args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs });
TensorInfo[] {
 const { inputs, backend, attrs } = args;
 const { value } = inputs;
 let { axis } = attrs;
 if (axis <

```

```

0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank
- 1);\n let outIndex = 0;\n for (let i = 0; i < rank; i++) {\n if (i !== axis) {\n outShape[outIndex++] =
value.shape[i];\n }\n }\n const outs: TensorInfo[] = new Array(numOutputs);\n const begin = new
Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n
begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size}, backend});\n }\n return
outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n }\n\n\nexport const unpackConfig: KernelConfig
= {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as {} as KernelFunc,\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Unpack.js.map

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No license file was found, but licenses were detected in source scan.

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the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =
backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
 const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n\n return out;\n }\n\n\nexport const addNConfig: KernelConfig = {\n kernelName:

```

AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n"]}

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js.map

No license file was found, but licenses were detected in source scan.

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=====
*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { padV2Config } from
 './PadV2';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape,
paddings } = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<number,
number> = [[0, 0]];\n completePaddings.push(...(paddings as Array<number, number>));\n for (let i = 1 +
blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX =
padV2Config.kernelFunc({\n inputs: { x },\n backend,\n attrs: { paddings: completePaddings, constantValue: 0 }\n }) as TensorInfo;\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,
blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n const reshapeInputs: ReshapeInputs = { x: paddedX };\n const reshapeAttrs:
ReshapeAttrs = { shape: reshapedPaddedShape };\n const paddedXReshaped =\n reshape({ inputs: reshapeInputs,
backend, attrs: reshapeAttrs });\n const transposeInputs: TransposeInputs = { x: paddedXReshaped };\n const transposeAttrs:
TransposeAttrs = { perm: permutedReshapedPaddedPermutation };\n const paddedXT =\n transpose({ inputs: transposeInputs, backend, attrs: transposeAttrs });\n const resultReshapeInputs: ReshapeInputs
= { x: paddedXT };\n\n const resultReshapeAttrs: ReshapeAttrs = { shape: flattenShape };\n const result = reshape(\n { inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs });\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as KernelFunc\n};\n\n"}\n
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.js.map

No license file was found, but licenses were detected in source scan.

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wasm.js", "../src/backend\_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT

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=====\n \*\n \* This enum must align with the enum defined in cc/backend.h.\n \* export enum CppDType { float32 = 0, int32 = 1, bool = 2, string = 3, complex64 = 4 }\n \* Must match enum in cc/fusable\_activations.h.\n \* export enum FusableActivation { linear = 0, relu = 1, relu6 = 2, prelu = 3, leakyrelu = 4, sigmoid = 5, elu = 6 }\n \*/\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n

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```

=====
*/\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,
biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
null /* void */, [\n 'number',
 // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n
'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n
'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' //
out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:
BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {a, b, bias,
preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB,
activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n
 const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new
Error(\n `_FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
 }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {}] as keyof typeof FusableActivation;\n if (fusedActivation == null) {\n throw
new Error(\n `_${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n
 }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,
transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return
out;\n }\n\n export const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n };,\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
}
=====
*/\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
 wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
 const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)

```

```

=== 0) {\n return out;\n };\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n };\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====
*\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n", "/*\n * @license\n
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: { backend: BackendWasm, inputs: BinaryInputs }):\n TensorInfo {\n const { backend, inputs } = args;\n const { a, b } = inputs;\n const aId =
backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n const outputType =
dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\n const out = backend.makeOutput(newShape, outputType);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32')\n {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return { kernelName, backendName: 'wasm', setupFunc,
kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required

```

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```
=====\n*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
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```
=====\n*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:\n Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:\n BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:\n TensorInfo[], backend: BackendWasm}) {\n const {inputs,\n backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-\n sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x\n => backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new\n Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,\n inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed
```

to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific\n language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nexport function\n identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =\n args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const\n identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n\n kernelFunc: identity as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

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*\\n\\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {identity} from
'/Identity';\\nimport {CppType}
from './types';\\n\\nlet wasmTranspose: (\\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
CppType,\\n outId: number, perm: Uint8Array, permLength: number) => void;\\n\\nfunction setup(backend:
BackendWasm) {\\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\\n 'number', // xId\\n
'array', // x.shape\\n 'number', // x.shape.length\\n 'number', // dtype\\n 'number', // outId\\n 'array', // perm\\n
'number', // perm.length\\n]);\\n\\n\\nexport function transpose(\\n args:\\n {inputs: TransposeInputs, backend:
BackendWasm, attrs: TransposeAttrs}):\\n TensorInfo {\\n const {inputs, backend, attrs} = args;\\n // Reduce any
dimensions with size one. Lower-rank transpose kernel performs\\n // better due to simpler memory access pattern.\\n
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\\n\\n let permIsNoOp = true;\\n for
(let i = 0; i < perm.length; i++) {\\n if (perm[i] !== i) {\\n permIsNoOp
= false;\\n }\\n }\\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\\n const x = {\\n dataId:
inputs.x.dataId,\\n shape: reducedShape,\\n dtype: inputs.x.dtype\\n };\\n\\n if (permIsNoOp) {\\n const cloned =
identity({inputs, backend});\\n cloned.shape = outShape;\\n return cloned;\\n }\\n\\n const out =
backend.makeOutput(outShape, x.dtype);\\n const xId = backend.dataIdMap.get(x.dataId).id;\\n const outId =
backend.dataIdMap.get(out.dataId).id;\\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\\n\\n wasmTranspose(\\n xId,
xShapeBytes, x.shape.length, CCppType[x.dtype], outId, permBytes,\\n perm.length);\\n return
out;}\\n\\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\\n const outShape = new
Array(inShape.length);\\n for (let i = 0; i < outShape.length; i++) {\\n outShape[i] = inShape[perm[i]];\\n }\\n
return outShape;}\\n\\nfunction
removeOneSizeDims(\\n shape: number[], perm: number[]): [number[], number[]] {\\n const newShape: number[]
= [];\\n const newPerm: number[] = [];\\n for (let i = 0; i < shape.length; ++i) {\\n if (shape[i] !== 1) {\\n
newShape.push(shape[i]);\\n }\\n if (shape[perm[i]] !== 1) {\\n newPerm.push(perm[i]);\\n }\\n }\\n for (let i =
0; i < newPerm.length; ++i) {\\n let minValIdx = -1;\\n for (let j = 0; j < newPerm.length; ++j) {\\n if
(newPerm[j] >= i &&\\n (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\\n minValIdx = j;\\n
 }\\n }\\n newPerm[minValIdx] = i;\\n }\\n return [newShape, newPerm];}\\n\\n\\nexport const transposeConfig:
KernelConfig = {\\n kernelName: Transpose,\\n backendName: 'wasm',\\n kernelFunc: transpose as {} as
KernelFunc,\\n setupFunc: setup,\\n};\\n"/**\\n * @license\\n * Copyright 2020 Google Inc. All Rights Reserved.\\n *
Licensed under the Apache License, Version 2.0 (the "License");\\n * you may not use this
file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\\nimport {BackendWasm} from
'../backend_wasm';\\nimport {transpose} from './Transpose';\\n"/**\\n * Compute permutation axes and do a transpose
if necessary.\\n * Used by reduction ops.\\n * @param x input TensorInfo\\n * @param axis reduction axes\\n *
@param backend wasm backend instance\\n */\\nexport function permuteAxesAndTranspose(\\n x: TensorInfo,
axis: number|number[],
backend: BackendWasm): {\\n transposed: TensorInfo|null,\\n axes: number[],\\n originalAxes: number[],\\n
inputWasTransposed: boolean\\n} {\\n const xShape = x.shape;\\n const xRank = x.shape.length;\\n\\n const
originalAxes = util.parseAxisParam(axis, xShape);\\n let axes = originalAxes;\\n const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\\n let xTransposed = null;\\n let inputWasTransposed = false;\\n if
(permutedAxes !== null) {\\n const newShape: number[] = new Array(xRank);\\n for (let i = 0; i <
newShape.length; i++) {\\n newShape[i] = xShape[permutedAxes[i]];\\n }\\n axes =

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backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n
}\n }\n\n return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};\n}\n", "/*\n * @license\n * Copyright 2021 Google LLC.
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file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet
wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:
{backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const
inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n
const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n
if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n

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const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n const [outShape, reduceShape] =\nbackend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n
 }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const anyConfig: KernelConfig = {\n
kernelName: Any,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: any as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====\n
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from
'/kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n\nfunction argmax(\n args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n const {backend, inputs, attrs} = args;\n
const {axis} = attrs as {} as ArgMaxAttrs;\n const {x} = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId
= xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n permuteAxesAndTranspose(x,
axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }
}\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
 }\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n
 kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====\n
*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
 '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:

```

```

number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
 const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
 const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
 const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
 throw new Error(\n `wasm backend does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1], ` +\n
 `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
 kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
\n\n
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount
for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
 kernelFunc: reshape as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */

```



```

=====
*\n\nimport
 {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const
{transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n
aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions
must either be the ` +\n `same or at least one input batch dimension must be 1. Got input ` +\n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and ` +\n ` ${innerShapeB} of Tensors with shapes
${a.shape} and ` +\n ` ${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation is
designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n
const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n
backend.disposeData(b3d.dataId);\n\n out.shape =
outShape;\n return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName:
BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbXuICBjb25zdCBbJGJlZ2luLCAk  
c2l6ZV0gPSBzbGljZV91dGlsLnBhcnNIU2xpY2VQYXJhbXMoeCwgYmVnaW4sIHNpemUpO1xuICBzbGljZV9  
1dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHGsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYW  
NrZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YXw1ZmM7XG4gIGNvbnN0IG91dFZhbmHMgPSBzbGljZULtG  
wodmFscywgJGJlZ2luLCAkc2l6ZSweC5zaGFwZSweC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2  
VUZW5zb3JjbmZvKCRzaXpILCB4LmR0eXBILCBvdXRWYWxzKTtcbn1cblXuZXhwb3J0IGNvbnN0IHNsaWN  
lQ29uZmlnOiBLZXJlZ2luLCAkdW5maWcgPSB7XG4gIGtlcm51bE5hbWU6IFNsaWNILFxcuICBiYWNRZW5kTmFtZ  
TogJ2NwdScsXG4gIGtlcm51bE51bmM6IHNsaWNlIGFzIHt9IGFzIEtlcm51bE51bmNcbn07XG4iXX0=", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version  
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for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {BackendUtil, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {sliceImplCPU} from
 './kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: [x], attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinous = slice_util.isSliceContinous(x.shape, begin_,
size_);\n\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const
xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype ===
'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +
util.sizeFromShape(size_)));\n }\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return
out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals
as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number,
number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n begin_ as [number, number, number, number], size_ as [number, number, number,
number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride:
number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i =
beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset +
size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction
slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:
backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <
endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:
backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number,
```

```

number)): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK =
begin[2];\n
const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL =
begin[3];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k <
endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n
outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }}\n }}\n
}\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc:
slice as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n const
permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n
attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig
= {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n *
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\n\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs,
backend: BackendWasm}): \n TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out =
backend.makeOutput(x.shape, dtype);\n const inVals = backend.toArrayFromHeap(x);\n const outVals =
backend.toArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const castConfig:

```



```
KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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```

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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
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```

```
=====\n*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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 law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmClip =
 backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
 max\n 'number' // out_id\n]);\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:
 BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
 backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n export const clipByValueConfig:
 KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip
 as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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 License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *
```

```
=====\n*\nimport
 {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
 core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from
 './kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\nexport function
 concat(\n args: {\n inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs\n }) {\n const {inputs, backend}
 = args;\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape =
 backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n // Keep only non-empty tensors (ignore tensors
 with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n const out = backend.makeOutput(outShape,
 inputs[0].dtype);\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n const shapes =
 $inputs.map(t
```

```

=> t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype === 'string') {\n //
Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional
tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis
to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these
two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to
have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors
along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n
const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape
=\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n
const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n };\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n
const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b *
sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset =
b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals,
outOffset);\n outOffset += innerDim;\n }\n }\n return out;\n }\n\nexport const concatConfig: KernelConfig =
{\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as { } as KernelFunc,\n};\n\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,
inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =

```

```

backend_util.convertConv2DDataFormat(dataFormat);\n
const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,\n
strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n\n const filterHeight =\n
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const\n
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =\n
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =\n
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\n
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =\n
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if\n
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support\n
dataFormat: ` +\n `${convInfo.dataFormat}`. Please\n
 use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =\n
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,\n
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,\n
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n\n}\n\nexport\n
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under

the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY

KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *

limitations under the License.\n *

=====*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,\n
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from\n
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,\n
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,\n
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number,\n
xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride:\n
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n\n
wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n `number`, // dyId\n
`number`, // filterId\n `number`, // batchSize\n `number`, // filterHeight\n `number`, // filterWidth\n
`number`, // inHeight\n `number`, // inWidth\n `number`, // inChannels\n `number`, // outHeight\n
`number`, // outWidth\n `number`, // outChannels\n `number`, // strideHeight\n `number`, // strideWidth\n
`number`, // topPad\n `number`, // leftPad\n `number`, // fltS0\n `number`, // fltS1\n `number`, // fltS2\n
`number`, // xBatchStride\n `number`, // xRowStride\n `number`, // xColStride\n `number`, // xChannelStride\n
`number`, // yBatchStride\n `number`, // yRowStride\n `number`, // yColStride\n
`number`, // yChannelStride\n `number`, // outId\n]);\n\n}\n\nfunction conv2DBackpropInput(args: {\n backend:\n
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,\n
dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =\n
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,\n
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n

```

```

inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n
const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
 filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n *
Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest

```



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finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n } \n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====\n
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace
= backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number',
// channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', // outputShape\n 'array', //
outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n}\n\nexport function depthToSpace(args: {\n
backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize
= x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth =
(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
: x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n
const outputDepth = inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,
'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====\n
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport

```

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{BackendWasm} from
'./backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number, inputHeight: number,
inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n
padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number,
dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number',
// dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n }) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const
{strides, dilations, pad, dimRoundingMode} = attrs;\n const $dilations = dilations === null ? [1, 1] : dilations;\n const
convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n const filterHeight = convInfo.filterHeight;\n const filterWidth
= convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n
const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
DepthwiseConv2dNative does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use
'channelsLast'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n }\n\n export const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n };
\n\n /**\n * @license\n * Copyright 2021 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n
* http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations\n * under the License.\n *
\n\n =====\n
\n * \n\n import {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n import {createUnaryKernelConfig} from
'./unary_kernel';\n export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for

```

the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an\n "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const expConfig: KernelConfig =\n createUnaryKernelConfig(Exp, 'float32');\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the\n "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an\n "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,\n KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from\n './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs:\n ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} =\n args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape\n = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${- (inputRank + 1)}, ${\n inputRank\n }]);\n $dim = inputRank + dim + 1;\n }\n\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs:\n {x: input}, backend, attrs: {shape: newShape}});\n\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the\n "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an\n "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {Fill, FillAttrs} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function fill(args: {attrs:\n FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape,\n value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals =\n backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n\n}\n\nexport const fillConfig:\n KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {} as\n KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the\n "License");\n * you may not\n use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
```



on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {\n KernelFunc,\n setupFunc: setup\n};\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from '../unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from '../binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
```

```

wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number', 'number']);\n\nfunction fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {\n KernelFunc\n };
}

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 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */

```

```

=====
\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null / void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n }) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {\n as keyof typeof FusableActivation\n }];\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for FusedConv2D` +\n ` in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got` +\n ` rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new

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Error(\n `FusedConv2D bias shape (${biasData.shape}) does not `+\n `match the number of output
channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n
const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth =
convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D
does not support dataFormat:`+\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha ||
0, outId);\n\n return out;\n }\n\n export const fusedConv2DConfig: KernelConfig = {\n kernelName:
FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as
KernelFunc\n };}\n ,"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n
'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n
'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n
'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n
'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function fusedDepthwiseConv2d(args: {\n
inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n
const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n

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dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation as { }
as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `_${activation}
activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
}\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias
shape (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n
}\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw
new Error(\n `wasm backend FusedDepthwiseConv2D does not support dataFormat:` +\n `_${dataFormat}`.
Please use 'NHWC'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0
:\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId,
batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CCppType, indicesId: number, numSlices: number,\n
sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n
'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const
{params, indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,
params.dtype);\n if (numSlices === 0) {\n return out;\n }\n\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n

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 const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const
 stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,
 numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig:
 KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
 gatherNd);\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
 Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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 =====\n
 *\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
 TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
 './backend_wasm';\nimport { reshape } from './Reshape';\nimport { CppDType } from './types';\n\nlet wasmGather:
 (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
 number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
 // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n
 'array', // outStrides\n 'number' // outId\n]);\n\nfunction gatherV2(\n args: { backend: BackendWasm,
 inputs: GatherV2Inputs, attrs: GatherV2Attrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const
 { x, indices } = inputs;\n const { axis, batchDims } = attrs;\n\n // Throw error when any index is out of bound.\n
 const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId)
 as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const
 index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2:
 the index value ${index} is not in [0, ${axisDim - 1}]`);\n }\n\n const shapeInfo =
 backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
 batchDims);\n\n const flattenX = reshape({\n inputs: { x },\n attrs: {\n shape: [\n
 shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n
 });\n\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: { x:
 indices },\n attrs: { shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize] },\n backend\n });\n
 const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n
 shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if
 (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n
 const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
 backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
 Int32Array(util.computeStrides(flattenX.shape)).buffer);\n\n const outStridesBytes = new Uint8Array(\n new
 Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
 xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
 shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
 GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc);\n};\n", "/*\n *
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```
=====\n*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n
```

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```
=====\n*\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
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```
=====\n*\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }):\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CCppType[x.dtype], alpha, outId);\n }\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc\n };\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
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```
=====\n*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
```

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```
=====\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, LogicalAnd } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: { backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { reductionIndices: axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
```

```

(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =
transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed)
{\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n
// reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n }\n\n return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n // TF API
supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it
because it uses xnpack which only\n // supports float32.\n // Add the following assert only for the WASM
backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype
=== 'float32',\n () =>\n `Error in MaxPool: only float32 input

```



```

is supported. Got ${x.dtype}.`);
const {filterSize, strides, pad, dimRoundingMode} = attrs;
const convInfo =
 backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);
const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft = convInfo.padInfo.left;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;
if (convInfo.dataFormat !== 'channelsLast') {
 throw new Error(\n `wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please use 'channelsLast'.`);
}
const out =
 backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,
 padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,
 strideHeight, strideWidth, inputChannels, outputChannels, outId);
return out;
}
export const maxPoolConfig: KernelConfig = {
 kernelName: MaxPool,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: maxPool as { } as KernelFunc;
};
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 */
=====
*/
import {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {cast} from './Cast';
import {permuteAxesAndTranspose} from './kernel_utils';
let wasmMean: (xId: number, reduceSize: number, outId: number) => void;
function setup(backend: BackendWasm): void {
 wasmMean = \n
 backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);
}
export function mean(\n args: {
 backend: BackendWasm,
 inputs: MeanInputs,
 attrs: MeanAttrs;
} \n TensorInfo {
 const {backend, inputs, attrs} = args;
 const {axis, keepDims} = attrs;
 const {x} = inputs;
 const xId = backend.dataIdMap.get(x.dataId).id;
 let inputId = xId;
 let input = x;
 const {transposed, axes, originalAxes, inputWasTransposed} = \n
 permuteAxesAndTranspose(x, axis, backend);
 let reductionAxes = axes;
 if (inputWasTransposed) {
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;
 if (transposedId !== xId) {
 // transpose was not a no-op. We will need to dispose of this
 // once we are done.
 input = transposed;
 inputId = transposedId;
 reductionAxes = backend_util.getInnerMostAxes(\n
 reductionAxes.length, input.shape.length);
 }
 }
 backend_util.assertAxesAreInnerMostDims(\n
 'mean', reductionAxes, input.shape.length);
 const [outShape, reduceShape] = \n
 backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
 const reduceSize = util.sizeFromShape(reduceShape);
 let castedInput = input;
 if (input.dtype !== 'float32') {
 castedInput = \n
 cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
 }
 inputId = backend.dataIdMap.get(castedInput.dataId).id;
}
const out =
 backend.makeOutput(outShape, 'float32');
if (util.sizeFromShape(input.shape) !== 0) {
 const outId = backend.dataIdMap.get(out.dataId).id;
 wasmMean(inputId, reduceSize, outId);
}
if (inputWasTransposed) {
 // dispose of the transposed tensor.
 backend.disposeData(transposed.dataId);
}
if (keepDims) {
 // reshape
 const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
 out.shape = newShape;
}
if (input.dtype !== 'float32') {
 backend.disposeData(castedInput.dataId);
}
return out;
}
export const meanConfig: KernelConfig = {

```

kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {} as  
KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the  
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min,
 null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function min(args: { backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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\* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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*\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from '../backend_wasm';
\n\nimport { CppDType } from './types';
\n\n// Must match enum in MirrorPad.cc
\nenum MirrorPaddingMode {
 \n reflect = 0,
 \n symmetric = 1
\n}
\nlet wasmMirrorPad: (
 \n xId: number,
 \n xShapeBytes: Uint8Array,
 \n xShapeLength: number,
 \n xDtype: number,
 \n prePaddingsBytes: Uint8Array,
 \n postPaddingsBytes: Uint8Array,
 \n mode: number,
 \n outId: number) => void;
\n\nfunction setup(backend: BackendWasm) {
 \n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [
 \n 'number', // xId
 \n 'array', // x.shape
 \n 'number', // x.shape.length
 \n 'number', // x.dtype
 \n 'array', // pre-paddings
 \n 'array', // post-paddings
 \n 'number', // mode
 \n 'number', // outId
 \n]);
\n\n function mirrorPad(args: {
 \n inputs: MirrorPadInputs,
 \n backend: BackendWasm,
 \n attrs: MirrorPadAttrs
 \n }) {
 \n const { inputs: { x }, backend, attrs: { paddings, mode } } = args;
 \n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);
 \n const xId = backend.dataIdMap.get(x.dataId).id;
 \n const out = backend.makeOutput(outShape, x.dtype);
 \n const outId = backend.dataIdMap.get(out.dataId).id;
 \n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
 \n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);
 \n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);
 \n const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
 \n const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);
 \n wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes, postPaddingsBytes, MirrorPaddingMode[mode], outId);
 \n return out;
 \n }
\n\n export const mirrorPadConfig: KernelConfig = {
 \n kernelName: MirrorPad,
 \n backendName: 'wasm',
 \n kernelFunc: mirrorPad as { } as KernelFunc,
 \n setupFunc: setup
 \n };
\n /**
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 \n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 \n * See the License for the specific language governing permissions and
 \n * limitations under the License.
 \n */
\n}
\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';
\n\nimport { createBinaryKernelConfig } from './binary_kernel';
\n\nconst supportsFullBroadcast = true;
\n\nexport const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);
\n /**
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 \n * limitations under the License.
 \n */
\n}
\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';
\n\nimport { createUnaryKernelConfig } from './unary_kernel';
\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);
\n /**
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 \n * limitations under the License.
 \n */
\n}
\n\nimport { BackendWasm } from '../backend_wasm';
\n\n// Analogous to `struct Result` in

```

```

`non_max_suppression_impl.h`.ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`.n */\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs};\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from
'./NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize:
number,\n iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', //
Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n
'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n}\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold,
scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n

```

```

'number',
// scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[]
{\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n
const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {}
as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n
 'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n}\n\nfunction
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
softNmsSigma);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from
the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n
backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n
return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config:
KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: kernelFunc as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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```

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```
=====\n*\nimport\n {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport\n {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue:\n number, offValue: number,\n outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n function oneHot(\n args:\n {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n const out =\n backend.makeOutput([\n ...indices.shape, depth\n], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n wasmOneHot(indicesId, depth,\n onValue, offValue, outId);\n return out;\n }\n export const oneHotConfig: KernelConfig = {\n kernelName:\n OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc\n };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nfunction onesLike(args: {inputs:\n OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName:\n 'wasm',\n kernelFunc: onesLike as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC.\n * All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express\n * or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
```

```
=====\n
```

```

*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from '../backend_wasm';\n\nimport {concat} from './Concat';\nimport
{expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim:
axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n
util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n
util.assert(\n
 dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n
expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n
return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n }\n\nexport const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as
KernelFunc\n};\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n 'number', // xId\n 'array', // x.shape\n
 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n
 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if
(util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n //
the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value:
constantValue, dtype: x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
outId = outTensorData.id;\n\n const xShapeBytes =
 new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
 new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
 Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n }\n\n export
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n };\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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```

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```
=====
*import {KernelConfig, Pow} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from
 './binary_kernel';
const supportsFullBroadcast = false;
export const powConfig: KernelConfig =
 createBinaryKernelConfig(Pow, supportsFullBroadcast);
"/**
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 */
```

```
=====
import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {cast} from './Cast';
let wasmPrelu: (xId: number,
 weightsId: number, outId: number) => void;
function setup(backend: BackendWasm) {
 wasmPrelu =
 backend.wasm.cwrap(Prelu, null /* void */, [
 'number', // x_id
 'number', // weights_id
 'number' //
 out_id
]);
 function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {
 const {inputs, backend}
 = args;
 const {x, alpha} = inputs;
 const xId = backend.dataIdMap.get(x.dataId).id;
 const weightsId = backend.dataIdMap.get(alpha.dataId).id;
 let inputId = xId;
 const input = x;
 let castedInput = input;
 if (input.dtype !== 'float32') {
 castedInput = cast({backend, inputs: {x}, attrs: {dtype:
 'float32'}});
 inputId = backend.dataIdMap.get(castedInput.dataId).id;
 }
 const out =
 backend.makeOutput(x.shape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 wasmPrelu(inputId, weightsId, outId);
 if (input.dtype !== 'float32') {
 backend.disposeData(castedInput.dataId);
 }
 return out;
 }
 export const preluConfig: KernelConfig = {
 kernelName: Prelu,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: prelu as {} as
 KernelFunc
 };
"/**
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 limitations under the License.
 */
```

```
=====
import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {permuteAxesAndTranspose} from './kernel_utils';
import {CppType} from './types';
let wasmProd: (xId: number, reduceSize: number,
 dtype: number, outId: number) => void;
function setup(backend:
 BackendWasm): void {
 wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [
 'number',
 'number',
 'number',
 'number'
]);
 function prod(args: {
 backend: BackendWasm,
 inputs: ProdInputs,
 attrs: ProdAttrs
 }):
 TensorInfo {
 const {backend, inputs, attrs} = args;
 const {axis, keepDims} = attrs;
 const {x} = inputs;
 const xId = backend.dataIdMap.get(x.dataId).id;
 let inputId = xId;
 let input = x;
 const {transposed, axes,
 originalAxes, inputWasTransposed} =
 permuteAxesAndTranspose(x, axis, backend);
 let reductionAxes =
 axes;
 if (inputWasTransposed) {
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;
 if
 (transposedId !== xId) {
 // transpose was not a no-op. We will need to dispose of this
 // once we are
```



```

done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =
backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n
backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape]
=\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const
range =\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } =
args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n
const
out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n
outVals.set(values);\n return out;\n };\n\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n
backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n"/**\n * @license\n *
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=====\n*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport\n {createUnaryKernelConfig} from './unary_kernel';\nexport const relu6Config: KernelConfig =\n createUnaryKernelConfig(Relu6);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nlet wasmResizeBilinear: (\n xId:\n number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\nfunction\n setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n function resizeBilinear(args: {\n backend:\n BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }): TensorInfo {\n const {backend,\n inputs, attrs} = args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size}\n = attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] =\n images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =\n backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =\n backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n const out =\n backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmResizeBilinear(\n xId, batch, oldHeight,\n oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n if\n (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n }\n export const\n resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n };\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
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 {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes:
 Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>
 void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
 out_shape_length\n 'number' // out_id\n]);\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs,
 backend: BackendWasm, attrs: ReverseAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
 {x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length
 === 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n
 const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
 Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
 outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
 backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
 kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
 setup\n};\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *
 =====\n
 *\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
 TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport
 {BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
 number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n
 fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
 batch\n 'number', // imageHeight\n 'number', // imageWidth\n
 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', //
 fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n}\n\nexport function rotateWithOffset(args: {
 inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n
 const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n
 const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
 backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
 imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
 backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
 fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
 fillIsBlack ? 0 : fullOpacityValue] : \n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new
 Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
 radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const
 rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
 kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n\n/**\n * @license\n * Copyright 2021
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=====\n\n*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific
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=====\n\n*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:\n number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)\n=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,\n null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //\n sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\nfunction scatterNd(\n args:\n {backend: BackendWasm, inputs:\n ScatterNdInputs, attrs:
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ScatterNdAttrs});

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TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape)\n === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =
```

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scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =\n backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =\n backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new\n Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n
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 setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId:
number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect
= backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n
'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
const selectConfig:
KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {} as KernelFunc,\n
setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm}
from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs});\n TensorInfo {\n
const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n
return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright
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*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n *
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=====\n*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmFunc: (xId: number, outId:\n number, channels: number, batch: number) =>\n void;\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n\nfunction softmax(\n args: { backend: BackendWasm,\n inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } =\n args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,\n logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if\n (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return\n out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
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=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { padV2Config } from\n './PadV2';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\nfunction\n spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:\n SpaceToBatchNDAttrs\n}) {\n const { inputs, backend,\n attrs } = args;\n const { x } = inputs;\n const { blockShape, paddings } = attrs;\n\n const prod =\n util.sizeFromShape(blockShape);\n const completePaddings: Array<[number, number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n for (let i = 1 + blockShape.length; i <\n x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX = padV2Config.kernelFunc({\n inputs: { x },\n backend,\n attrs: { paddings: completePaddings, constantValue: 0 }\n }) as TensorInfo;\n const\n reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n const\n permutedReshapedPaddedPermutation =\n backend_util.getPermuted(\n reshapedPaddedShape.length,\n blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,\n blockShape, prod, false);\n const reshapeInputs: ReshapeInputs = { x: paddedX };\n const reshapeAttrs:\n ReshapeAttrs = { shape: reshapedPaddedShape };\n\n const paddedXReshaped =\n reshape({ inputs: reshapeInputs, backend, attrs: reshapeAttrs });\n const\n transposeInputs: TransposeInputs = { x: paddedXReshaped };\n const transposeAttrs:\n TransposeAttrs = { perm:\n permutedReshapedPaddedPermutation };\n const paddedXT =\n transpose({ inputs: transposeInputs, backend,\n attrs: transposeAttrs });\n const resultReshapeInputs: ReshapeInputs = { x: paddedXT };\n const\n resultReshapeAttrs: ReshapeAttrs = { shape: flattenShape };\n const result = reshape(\n { inputs:\n resultReshapeInputs, backend, attrs: resultReshapeAttrs });\n\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return\n result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
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*
\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-core';
import { backend_util } from '@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import { slice } from './Slice';
export function splitV(args: { inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm }) {
 const { inputs, attrs, backend } = args;
 const x = inputs;
 const { numOrSizeSplits, axis } = attrs;

 const $axis = util.parseAxisParam(axis, x.shape)[0];
 const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);
 const begin = new Array(x.shape.length).fill(0);
 const size = x.shape.slice();
 return splitSizes.map(s => {
 const xSliceSize = [...size];
 xSliceSize[$axis] = s;
 const xSlice = slice({ inputs: { x }, attrs: { begin, size: xSliceSize }, backend });
 begin[$axis] += s;
 return xSlice;
 });
}

export const splitVConfig: KernelConfig = {
 kernelName: SplitV,
 backendName: 'wasm',
 kernelFunc: splitV as { } as KernelFunc
};
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 * limitations under the License.
 */
```

```
=====
*
\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';
import { createUnaryKernelConfig } from './unary_kernel';
export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);
"/**
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 * limitations under the License.
 */
```

```
=====
*
\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';
import { createUnaryKernelConfig } from './unary_kernel';
export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);
"/**
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 * limitations under the License.
 */
```

```
=====
*
\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';
import { createBinaryKernelConfig } from './binary_kernel';
const supportsFullBroadcast = true;
export const squaredDifferenceConfig: KernelConfig =
 createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);
"/**
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```

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IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array, xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n}\n\nexport function stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {\n begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse, finalShape, isIdentity, sliceDim0, isSimpleSlice,\n begin: $begin, end: $end, strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is memory contiguous\n (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
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'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
 Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
 Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
 stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n new
 Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
 new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
 beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
 result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
 }\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
 backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n"/**\n *
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 language governing permissions and\n * limitations under the License.\n *
 =====\n
 */\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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 express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
 the License.\n *
 =====\n
 */\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
 {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
 number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
 BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
 SumAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} =
 attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId =
 xId;\n let input = x;\n\n const
 {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n
 let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
 backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
 not a no-op. We
 will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
 transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
 input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum',
 reductionAxes, input.shape.length);\n const [outShape,
 reduceShape]
 =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if

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(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n };\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except\n in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law\n or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:\n number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =\n backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //\n x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return\n out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All

```

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk: (\n args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) => (\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n });\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as { } as KernelFunc,\n }; \n /**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /* void */, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number', // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }): (\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth, numChannels] as
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[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n
 const out = backend.makeOutput(outShape, image.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId =
4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n}\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
'./Slice';\n\nfunction unpack(\n args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n TensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({ inputs: { x: value }, attrs: { begin, size },
backend});\n }\n return outs.map(({ dataId, dtype }) => ({ dataId, dtype,
shape: outShape }));\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName:
'wasm',\n kernelFunc: unpack as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm }
from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend: BackendWasm }) {\n
const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as { } as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```

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=====

```
We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';
import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {equalConfig} from './kernels/Equal';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {leakyReluConfig} from './kernels/LeakyRelu';
import {lessConfig} from './kernels/Less';
import {lessEqualConfig} from './kernels/LessEqual';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maxConfig} from './kernels/Max';
import {maximumConfig} from './kernels/Maximum';
import {maxPoolConfig} from './kernels/MaxPool';
import {meanConfig} from './kernels/Mean';
import {minConfig} from './kernels/Min';
import {minimumConfig} from './kernels/Minimum';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {notEqualConfig} from './kernels/NotEqual';
import {oneHotConfig} from './kernels/OneHot';
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {resizeBilinearConfig} from './kernels/ResizeBilinear';
import {reverseConfig} from './kernels/Reverse';
import {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
import {roundConfig} from './kernels/Round';
```

```

./kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
./kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n
=====\n
*/\nimport {env} from '@tensorflow/tfjs-core';\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*/\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n])));\n\n/**\n * True if threads are supported.\n
*/\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n try {\n

```

```

// Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n}\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
})return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
})return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram="/.this.program";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"];var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]";}var

```

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nodeWorkerThreads;try{nodeWorkerThreads=require(\`worker_threads\`)catch(e){console.error("The
\`worker_threads\` module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\`undefined\`){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\`function\`){return new
Uint8Array(readbuffer(f))}data=read(f,\`binary\`);assert(typeof data===\`object\`);return data};if(typeof
scriptArgs!=\`undefined\`){arguments_=scriptArgs}else if(typeof
arguments!=\`undefined\`){arguments_=arguments}if(typeof
quit===\`function\`){quit_=function(status){quit(status)}}if(typeof print!=\`undefined\`){if(typeof
console===\`undefined\`)console={};console.log=print;console.warn=console.error=typeof
printErr!=\`undefined\`?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\`undefined\`&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\`undefined\` &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\`blob:\`)!==(0)){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\`^\`)+1)}else{scriptDirectory=\`\/\`}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\`fs\`);if(!nodePath)nodePath=require(\`path\`);filename=n
odePath[\`normalize\`](filename);return
nodeFS[\`readFileSync\`](filename,binary?null:\`utf8\`);readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\`GET\`,url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\`GET\`,url,false);xhr.responseType=\`arraybuffer\`;xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\`GET\`,url,true);xhr.responseType=\`arraybuffer\`;xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\`undefined\`){global.performance=require(\`perf_hooks\`).performance}}var
out=Module[\`print\`]||console.log.bind(console);var err=Module[\`printErr\`]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\`arguments\`]arguments_=Module[\`arguments\`];if(Module[\`thisProgram\`]thisProgram=
Module[\`thisProgram\`];if(Module[\`quit\`]quit_=Module[\`quit\`];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\`wasmBinary\`]wasmBinary=Module[\`wasmBinary\`];var
noExitRuntime=Module[\`noExitRuntime\`]||true;if(typeof WebAssembly!=\`object\`){abort(\`no
native wasm support detected\`)}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[\`_\`+ident];assert(func,\`Cannot call unknown function \"+ident+\`, make sure
it is exported`);return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\`string\`:function(str){var ret=0;if(str!=null&&str!=undefined&&str!=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\`array\`:function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\`string\`)return UTF8ToString(ret);if(returnType===\`boolean\`)return

```



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Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!==\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module[\"wasmMemory\"]};buffer=Module[\"buffer\"]}else{if(Module[\"wasmMemory\"]){wasmMemory=
Module[\"wasmMemory\"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --

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experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\\"bad
memory\")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlobalBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var __ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module[\"preRun\"]){if(typeof Module[\"preRun\"]!=\"function\")Module[\"preRun\"]=[Module[\"preRun\"]];while(Module[\"preRun\"].length){addOnPreRun(Module[\"preRun\"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module[\"postRun\"]){if(typeof Module[\"postRun\"]!=\"function\")Module[\"postRun\"]=[Module[\"postRun\"]];while(Module[\"postRun\"].length){addOnPostRun(Module[\"postRun\"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\\\"addRunDependency cannot be used in a
pthread
worker\\");runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}if(ENVIRONMENT_IS_PTHREAD)console.error(\\\"Pthread aborting at \\\"+(new
Error).stack);what+=\\\"\\\";err(what);ABORT=true;EXITSTATUS=1;what=\\\"abort(\\\"+what+\\\"). Build with -s
ASSERTIONS=1 for more info.\\\";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\\\"data:application/octet-stream;base64,\\\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\\\"file://\\\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\\\"tfjs-backend-wasm-threaded-
simd.wasm\\\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinaryFile){return new
Uint8Array(wasmBinaryFile)}if(readBinary){return readBinary(file)}else{throw\\\"both async and sync fetching of the
wasm failed\\\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinaryFile&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\\\"same-origin\\\"}).then(function(response){if(!response[\\\"ok\\\"]){throw\\\"failed to load wasm binary file at
\\\"+wasmBinaryFile+\\\"\\\"}}return
response[\\\"arrayBuffer\\\"]()).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\\\"a\\\":asmLibraryArg};function

```

```

receiveInstance(instance,module){ var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){ var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency("\wasm-
instantiate\");}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("\wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"]);function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFile)
&&typeof fetch===\function\"){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("\wasm streaming compile failed: "+reason);err("\falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm\"){try{var
exports=Module["instantiateWasm\"](info,receiveInstance);return exports}catch(e){err("\Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(Promise.reject);return{}}var
ASM_CONSTS={10520:function(){throw\Canceled!\},10538:function($0,$1){setTimeout(function(){__emscripten_
do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,EBADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EBUSY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENODIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,ENOTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERANGE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADDE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:128,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFUSED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOSTDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,EPROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,ENOTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:148,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)return-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainThreadWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return

```

```

1 } } var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw`"Atomics.notify returned an unexpected value
`"+ret}Module[["_emscripten_futex_wake"]="_emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined }functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! cancelThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd\":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! cleanupThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
cleanupThread!";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)} }var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);_emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb);,initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){ while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop();if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors();runExitHandlersAndDeinitThread:function(tb,exitCode){ Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);_emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\":"exit"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\":"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)} }PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null },returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker

```

```

s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined));,runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"]);}else
if(cmd===\'killThread\'){killThread(d["thread"]);}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"]);}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\'print\'){out("Thread \''+d["threadId"]+'': \''+d["text"]')}else
if(cmd===\'printErr\'){err("Thread \''+d["threadId"]+'': \''+d["text"]')}else if(cmd===\'alert\'){alert("Thread
'+d["threadId"]+'': \''+d["text"]')}else if(cmd===\'exit\'){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\'setimmediate\'){worker.postMessage(e.data)}else{err(\'worker sent an unknown command
'+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\'pthread sent
an error! \''+e.filename+'':\''+e.lineno+'':
'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
ata});});worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
Message({'cmd':\'load\',\'urlOrBlob':Module["mainScriptUrlOrBlob"]||_scriptDir,\'wasmMemory':wasmMe
memory,\'wasmModule':wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile('tfjs-backend-wasm-threaded-simd.worker.js');PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("Assertion failed: '"+UTF8ToString(condition)+'', at:
'+[filename?UTF8ToString(filename):\'unknown filename\',line,func?UTF8ToString(func):\'unknown
function\'])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else

```

```

if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]} }else if(typeof
dateNow!=="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({"cmd\":"processQueuedMainThreadWork"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread\":targetThreadId,"cmd\":"processThreadQueue
e"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd\":"processThreadQueue"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret==="timed-out")return-
73;if(ret==="not-equal")return-6;if(ret==="ok")return
0;throw"Atomics.wait returned an unexpected value
"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)
==val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf];++buf)}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function

```

```

emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case

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1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread} },getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;_emsripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension(\"ANGLE_instanced_arrays\");if(ext){ctx[\"vertexAttribDivisor\"]=function(index,divisor){ex
t[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcou
nt){ext[\"drawArraysInstancedANGLE\"](mode,first,count,primcount)};ctx[\"drawElementsInstanced\"]=function(
mode,count,type,indices,primcount){ext[\"drawElementsInstancedANGLE\"](mode,count,type,indices,primcount)};

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return
 1 } }function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ ctx["createVertexArray"]=function(){ return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1 } }function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ ctx["drawBuffers"]=function(n,bufs){ ext["drawBuffers
WEBGL"](n,bufs)};return 1 } }function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function
 recordError(errorCode){ if(!GL.lastError){ GL.lastError=errorCode } },getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;i++){ table[i]=null }return
ret },getSource:function(shader,count,string,length){ var source="";for(var i=0;i<count;++i){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32)[string+i*4>>2],len<0?undefined:len }return
source },createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle },registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context) }return
handle },makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){ return
GL.contexts[contextHandle] },deleteContext:function(contextHandle){ if(GL.currentContext===GL.contexts[contex
tHandle])GL.currentContext=null;if(typeof
JSEvents===object)JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null },initExtensions:f
unction(context){ if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){ if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){ GLctx.getExtension(ext) } } }),populateUniformTable:function(program){ var
p=GL.programs[program];var
ptable=GL.programInfos[program]={ uniforms:{ },maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1 };var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){ var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-

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1)=="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iow,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32)[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom

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ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
 global_libc=_emscripten_get_global_libc();var
 global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthead=pthread;var
 msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":threadParams.pthead_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded){worker.runPthead();delete worker.runPthead}}function
 _pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current environment does not support SharedArrayBuffer, pthreads are not available!\");return 6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\");return 28}var transferList=[];var error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return _emscripten_sync_run_in_main_thread_4(687865856,pthead_ptr,attr,start_routine,arg)}if(error)return error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==(0)}else{stackSize=2097152}var allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthead_ptr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached,startRoutine:start_routine,pthead_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_PTHREAD){threadParams.cmd=\\"spawnThread\\";postMessage(threadParams,transferList)}else{spawnThread(threadParams)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var tb=_pthread_self();if(!tb)return;var cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\\"Canceled!\"}function _emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKER)return;warnOnce(\\"Blocking on the main thread is very dangerous, see https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\\")}function __emscripten_do_pthead_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread pointer!\");return ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err(\\"PThread \"+thread+\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err(\\"Main thread \"+thread+\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!=thread){err(\\"pthread_join attempted on thread \"+thread+\\", which does not point to a valid thread, or does not exist anymore!\");return ERRNO_CODES.ESRCH}var detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\\"Attempted to join thread \"+thread+\\", which was already detached!\");return ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)cleanupThread(thread);else postMessage({\\"cmd\\":\\"cleanupThread\\",\\"thread\\":thread});return

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0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thread_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1)}function
pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wri
te,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var

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_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][_"K"]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][_"L"]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][_"M"]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][_"N"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][_"O"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][_"P"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][_"Q"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][_"R"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][_"T"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][_"U"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][_"V"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][_"W"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_" "]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments)};var

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_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"]]).apply(null,arguments)};var

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_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"Ea"]).apply(
null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"Fa"]).apply(
null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"Ga"]).apply(
null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(
null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(
null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).
apply(
null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(
null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(
null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=
Module["asm"][_"Ma"]).apply(
null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).
apply(
null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][_"Oa"]).apply(
null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(
null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(
null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra
"]).apply(
null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).
apply(
null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).
apply(
null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(
null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).
apply(
null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(
null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(
null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][_"Ya"]).apply(
null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(
null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][_"a"]).apply(
null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Sa"]).apply(
null,arguments)};var

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_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][\`ab\`]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][\`bb\`]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][\`cb\`]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][\`db\`]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][\`eb\`]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][\`fb\`]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][\`gb\`]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][\`hb\`]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][\`ib\`]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][\`jb\`]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][\`kb\`]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][\`lb\`]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][\`mb\`]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][\`nb\`]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][\`ob\`]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][\`pb\`]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][\`qb\`]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][\`rb\`]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][\`sb\`]).apply(null,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){return(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"][\`tb\`]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=

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Module["asm"][["ub"]].apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]].apply(null,arguments)};var
__emscripten_tls_init=Module["__emscripten_tls_init"]=function(){return(__emscripten_tls_init=Module["_emscript
en_tls_init"]=Module["asm"][["wb"]].apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"][["xb"]].apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]].a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][["zb"]].apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ab"
]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=function(){return(__emscripten_stack_set
limits=Module["_emscripten_stack_set_limits"]=Module["asm"][["Bb"]].apply(null,arguments)};var
__memalign=Module["_memalign"]=function(){return(__memalign=Module["_memalign"]=Module["asm"][["Cb
"]].apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module["__emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module["__emscripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun(),1})}else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run(
);\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n));\nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"]
= WasmBackendModuleThreadedSimd;\n","export const wasmWorkerContents = 'var Module={};function
threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function
threadAlert(){var text=Array.prototype.slice.call(arguments).join(
\n");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]})}var

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err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===\load\"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===\string\){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})else
if(e.data.cmd===\objectTransfer\"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\run\"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"](),1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module[
"PThread"].threadExit(result)}catch(ex){if(ex===\Canceled!\){Module["PThread"].threadCancel()}else
if(ex!==\unwind\"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd===\cancel\"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}else
if(e.data.target===\setimmediate\){}else
if(e.data.cmd===\processThreadQueue\"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]())}else{err(\worker.js received unknown command
\'+e.data.cmd);err(e.data)}}catch(ex){err(\worker.js onmessage() captured an uncaught exception:
\'+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\object\&&typeof
process.versions===\object\&&typeof process.versions.node===\string\){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\message",function(data){onmessage({data:data}});var
nodeFS=require(\fs");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\utf8");};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\undefined\){performance={now:function(){return Date.now()}}};",\nvar
WasmBackendModule=(function(){\n var _scriptId=typeof document !==\undefined' &&
document.currentScript?document.currentScript.src:undefined;\n if(typeof __filename !==\undefined')
_scriptDir=_scriptId||__filename;\n return (\nfunction(WasmBackendModule){\n WasmBackendModule=
WasmBackendModule||{};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var
arguments_=[];var thisProgram=\.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var

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ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\")}arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inSp
ect\"]=function(){return\"[Emscripten Module object]\"}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else
if(typeof arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!=\"0\")scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"]};if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"]};if(Module[\"quit\"]quit_=Module[\"quit\"]};var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"]};var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object"){abort(\"no native wasm
support detected\")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort(\"Assertion failed:
\"+text)}}function getCFunc(ident){var func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function

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\ "+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){ var
toC={"string":function(str){ var ret=0;if(str!==null&&str!==undefined&&str!==0){ var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\ "array":function(arr){ var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret }};function
convertReturnValue(ret){ if(returnType===\ "string")return UTF8ToString(ret);if(returnType===\ "boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){ if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{ cArgs[i
]=args[i] }}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){ return type===\ "number"});var
numericRet=returnType!==\ "string";if(numericRet&&numericArgs&&!opts){ return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} }var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder(\ "utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){ return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{ var
str="" ;while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){ str+=String.fromCharCode(u0);continue }var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue }var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2}else{ u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){ str+=String.fromCharCode(u0)}else{ var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} }return str}function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\ ""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){ if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023}if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else { if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63} }heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){ if(x%multiple>0){ x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module[\ "HEAP8"] =HEAP8=new
Int8Array(buf);Module[\ "HEAP16"] =HEAP16=new Int16Array(buf);Module[\ "HEAP32"] =HEAP32=new
Int32Array(buf);Module[\ "HEAPU8"] =HEAPU8=new Uint8Array(buf);Module[\ "HEAPU16"] =HEAPU16=new
Uint16Array(buf);Module[\ "HEAPU32"] =HEAPU32=new
Uint32Array(buf);Module[\ "HEAPF32"] =HEAPF32=new
Float32Array(buf);Module[\ "HEAPF64"] =HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\ "INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({ func:function(){ __wasm_call_ctors()}});function
preRun(){ if(Module[\ "preRun"]){ if(typeof
Module[\ "preRun"]!="function")Module[\ "preRun"]=[Module[\ "preRun"]];while(Module[\ "preRun"].length){ a

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ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].length)
}{addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
dependencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer
instantiate");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var

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exports=Module["instantiateWasm"](info,receiveInstance);return exports } catch(e){ err("Module.instantiateWasm
callback failed with error: "+e);return false } }instantiateAsync().catch(Promise.reject);return{ } }function
callRuntimeCallbacks(callbacks){ while(callbacks.length>0){ var callback=callbacks.shift();if(typeof
callback=="function"){ callback(Module);continue }var func=callback.func;if(typeof
func=="number"){ if(callback.arg===undefined){ wasmTable.get(func)() }else{ wasmTable.get(func)(callback.arg)
} }else{ func(callback.arg===undefined?null:callback.arg) } } }function _abort(){ abort() }function
_emscipten_memcpy_big(dest,src,num){ HEAPU8.copyWithin(dest,src,src+num) }function
_emscipten_get_heap_size(){ return HEAPU8.length }function
emscipten_realloc_buffer(size){ try{ wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1 } catch(e){ } }function _emscipten_resize_heap(requestedSize){ var oldSize=_emscipten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){ return false }for(var
cutDown=1;cutDown<=4;cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscipten_realloc_buffer(newSize);if(replacement){ return true } }return false }var
SYSCALLS={ mappings:{ },buffers:[null,[],[]],printChar:function(stream,curr){ var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){ (stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0 }else{ buffer.push(curr) },varargs:undefined,get:function(){ SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret },getStr:function(ptr){ var ret=UTF8ToString(ptr);return
ret },get64:function(low,high){ return
low } };function _fd_close(fd){ return 0 }function _fd_seek(fd,offset_low,offset_high,whence,newOffset){ }function
_fd_write(fd,iiov,iiovent,pnum){ var num=0;for(var i=0;i<iiovent;i++){ var ptr=HEAP32[iiov+i*8>>2];var
len=HEAP32[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){ SYSCALLS.printChar(fd,HEAPU8[ptr+j]) } num+=len }HEAP32[pnum>>2]=num;return 0 }function
_thread_create(){ return 6 }function _pthread_join(){ return 28 }function
setErrNo(value){ HEAP32[___errno_location()>>2]=value;return value }function
_sysconf(name){ switch(name){ case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{ if(typeof navigator=="object")return navigator["hardwareConcurrency"]||1;return 1 } }setErrNo(28);return-
1 } }var
asmLibraryArg={"a":_abort,"d":_emscipten_memcpy_big,"e":_emscipten_resize_heap,"f":_fd_close,"c":_f
d_seek,"b":_fd_write,"h":_pthread_create,"g":_pthread_join,"i":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module["__wasm_call_ctors"]=function(){ return(__wasm_call_ctors=Module["__wasm
_call_ctors"]=Module["asm"]["k"]).apply(null,arguments) };var
__init=Module["__init"]=function(){ return(__init=Module["__init"]=Module["asm"]["l"]).apply(null,arguments) };

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var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Module["_init_with_threads_count"]=Module["asm"][["m"]]).apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads_count"]=Module["asm"][["n"]]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["asm"][["o"]]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"][["p"]]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"][["q"]]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"][["s"]]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][["t"]]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["v"]]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["w"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)}

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;var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm\"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm\"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm\"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm\"][["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm\"][["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm\"][["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm\"][["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["asm\"][["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm\"][["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm\"][["U"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm\"][["V"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm\"][["W"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm\"][["X"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm\"][["Y"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm\"][["Z"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm\"][["_"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm\"][["$"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm\"][["aa"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm\"][["ba"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm\"][["ca"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm\"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm\"][["ea"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm\"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm\"][["g

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a").apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,argument
s)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"
]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(nul
l,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,argu
ments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).app
ly(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,argume
nts)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,ar
guments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arg
uments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa
"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]])
.apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).ap
ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)
};var

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_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["Va"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"]]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain();
readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(

```

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 })if(Module["setStatus\"]) { Module["setStatus\"]("Running...");setTimeout(function() {setTimeout(function() {Module["setStatus\"]("\n"),1});doRun(),1)}else {doRun()} }Module["run"]=run;if(Module["preInit\"]) {if(typeof Module["preInit"]==\"function\")Module["preInit"]=[Module["preInit\"]];while(Module["preInit"].length>0){Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n\n}();\nif (typeof exports === 'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define === 'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports === 'object')\n exports[\"WasmBackendModule\"] = WasmBackendModule;\n", /**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====
*/\nimport './flags_wasm';\nimport { backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,\n engine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasmModule,\n WasmFactoryConfig } from './wasm-out/tfjs-backend-wasm';\nimport { BackendWasmThreadedSimdModule } from './wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport { wasmWorkerContents } from './wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface\n TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:\n number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n }\n\nexport\n type DataId = object; // object instead of { } to force non-primitive.\n\nexport class BackendWasm extends\n KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:\n DataStorage<TensorData>;\n\n constructor(public\n wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:\n number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return\n this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =\n util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:\n DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const\n size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const\n memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n refCount});\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n\n async\n read(dataId: DataId): Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return\n stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n * otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n }

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disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n}\n\n/** Return refCount of a `TensorData`. */\nrefCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n}\n\nincRef(dataId: DataId) {\n const data =
this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n}\n\nfloatPrecision(): 32 {\n return 32;\n}\n\n// Returns the memory offset of a tensor. Useful for debugging and unit\n// testing.\ngetMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n}\n\ndispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n}\n\nmemory() {\n return {unreliable:
false};\n}\n\n/**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\nmakeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n}\n\ntypedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n
case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new
Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,
size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nfunction
createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n
WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n
});\n});\n});\n return {};\n};\n}\n\n/**\n * Returns the path of the WASM binary.\n */\n@param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\nfunction getPathToWasmBinary(\n
 simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null)
{\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n */\n * NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n */\nexport async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported,
threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n *
@param prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n

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if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n } \n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n
};\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the '+\n 'bundled
js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-
bundlers';\n reject({message: rejectMsg});\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If
`.wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported
&& wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob(\n [var
WasmBackendModuleThreadedSimd = `+\n wasmFactoryThreadedSimd.toString()],\n {type:
'text/javascript'});\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory
works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM
module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType:
string
= null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
 'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };;\n\n resolve({ wasm: module });\n
 });\n });\n\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n
 case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n
 }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-
backend-wasm-threaded-simd.wasm'\n] as const ;\n\ntype WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport
function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n 'setWasmPath has
been deprecated in favor of setWasmPaths and'+\n ' will be removed in a future release.);\n if (initAborted) {\n
 throw new Error(\n 'The WASM backend was already initialized. Make sure you call '+\n 'setWasmPath`\n
before you call `tf.setBackend()` or `tf.ready()`');\n }\n wasmPath = path;\n customFetch =

```



KAAjB,iBAaIB;AC3B7B;,,,,,,,,,,,,,,,,,,,,,AAuBA,IAAI,eAKQ,CAAC;AAEb,SAAS,KAAK,CAAC,OAAoB;IACjC,eA Ae,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,YAAY,EAAE,IAAI,aAAa;QACIE,QAAQ;QACR,OAAO;Q ACP,QAAQ;QACR,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,Q AAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,gBAAGB,C AAC,IAIzB;IACC,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IACtC,MAA M,EAAE,CAAC,EAAE,CAAC,EAAE,IAAI,EAAE,sBAAsB,EAAC,GAAG,MAAM,CAAC;IAEpD,IAAI,CAAC, CAAC,KAAK,KAAK,SAAS,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,EAAE;QACID,MAAM,IAAI,KAAK,CA CX,6DAA6D,CAAC,CAAC;KACpE;IAED,MAAM,EAAC,UAAU,EAAE,UAAU,EAAE,UAAU,EAAE,cAAc,EA AC,GAAG,KAAK,CAAC;IACnE,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CA AC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CA AC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;IACf,IAAI, IAAI,IAAI,IAAI,EAAE;QACb,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC, MAAM,CAAC,CAAC;QACpD,IAAI,QAAQ,CAAC,KAAK,CAAC,MAAM,KAAK,CAAC,EAAE;YAC/B,MAA M,IAAI,KAAK,CACX,iDAaiD;gBACjD,QAAQ,QAAQ,CAAC,KAAK,CAAC,MAAM,GAAG,CAAC,CAAC;SA CvC;QACD,MAAM,GAAG,QAAQ,CAAC,EAAE,CAAC;KACTB;IACD,MAAM,wBAAwB,GAAG,sBAAsB,IAA I,IAAI;QAC3D,CAAC;QACD,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAA C,EAAE,CAAC;IAC5D,MAAM,eAAe,GACjB,iBAaIB,CAAC,UAAkD,CAAC,CAAC;IACIE,IAAI,eAAe,IAAI, IAAI,EAAE;QAC3B,MAAM,IAAI,KAAK,CACX,GAAG,UAAU,gDAAGD;YAC7D,sBAAsB,CAAC,CAAC;KAC 7B;IAED,MAAM,OAAO,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAA C,KAAK,CAAC,CAAC,CAAC,CAAC;IACrD,MAAM,QAAQ,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAA C,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IACtD,MAAM,QAAQ,GAAG,CAA C,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IAE5B,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAA C,QAAQ,EAAE,OAAO,EAAE,QAAQ,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACvE,MAAM,KAA K,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEn D,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM ,CAAC,CAAC;IACnE,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,C AAC,CAAC,MAAM,CAAC,CAAC;IAEnE,eAAe,CACX,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CA AC,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,UAAU,EAAE,U AAU,EAAE,eAAe,EAAE,MAAM,EAAE,wBAAwB,EACzE,cAAc,IAAI,CAAC,EAAE,KAAK,CAAC,CAAC;IAE hC,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,MAAM,iBAaIB,GAAiB;IAC7C,UAAU,EAAE,YAAY;IACxB,W AAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IACb,UAAU,EAAE,gBAAoC;CACjD;AC7GD;,,,,,,,,,,,,,S AuBgB,uBAAuB,CACnC,UAAkB,EAAE,OAAkB;IACxC,IAAI,QAA6D,CAAC;IAEIE,SAAS,SAAS,CAAC,OAA oB;QACrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ; YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAAC;KACJ;IAED,SAAS,UAAU,CAAC,IAAiD;QAEEnE,MAAM,E AAC,OAAO,EAAE,MAAM,EAAE,EAAC,CAAC,EAAC,EAAC,GAAG,IAAI,CAAC;QACpC,MAAM,GAAG,G AAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,M AAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KA AK,CAAC,CAAC;QAC5D,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,M AAM,CAAC,CAAC,EAAE,CAAC;QAGnD,IAAI,IAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAA K,CAAC,EAAE;YACvC,OAAO,GAAG,CAAC;SACZ;QAED,QAAQ,CAAC,GAAG,EAAE,QAAQ,CAAC,CAA C,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;QACxC,OAAO,GAAG,CAAC;KACZ;IAED,OAAO,EAAC ,UAAU,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,EAAE,UAAU,EAAC,CAAC;AACIE;ACpDA;,,,,,,,,,,,,,A AoBO,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC;ACpBnE;,,,,,,,,,,,,,SAuBgB,wBAAwB,CACpC,U AAKB,EAAE,qBAA8B,EACID,KAAgB;IACIB,IAAI,QAGQ,CAAC;IAEb,SAAS,SAAS,CAAC,OAAoB;QACrC, QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ;YACR,OA AO;YACP,QAAQ;YACR,QAAQ;YACR,OAAO;YACP,QAAQ;YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAA C;KACJ;IAED,SAAS,UAAU,CAAC,IAAkD;QAEpE,MAAM,EAAC,OAAO,EAAE,MAAM,EAAC,GAAG,IAAI, CAAC;QAC/B,MAAM,EAAC,CAAC,EAAE,CAAC,EAAC,GAAG,MAAM,CAAC;QACTB,MAAM,GAAG,GAA

G,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,MAA  
M,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAA  
C;QAE/C,MAAM,UAAU,GAAG,KAAK,IAAI,IAAI,GAAG,KAAK,GAAG,CAAC,CAAC,KAAK,CAAC;QACnD  
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C,CAAC;QAC3E,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,UAAU,CAAC,CAAC;;QA  
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EAAE,SAAS,EAAE,GAAG,EAAE,eAAe,EAAC,GAAG,KAAK,CAAC;IAEzD,MAAM,UAAU,GAAG,SAAS,IAAI,IAAI,GAAG,CAAC,CAAC,EAAE,CAAC,CAAC,GAAG,SAAS,CAAC;IAE1D,MAAM,QAAQ,GAAG,YAAY,CAAC,iBAaiB,CAC1C,CAAc,CAAC,KAAK,EAAG,MAAmB,CAAC,KAAK,EAAE,OAAO,EACzD,UAAwC,EAAE,GAAG,EAAE,eAAe,EAC/D,IAAI,iBAaiB,CAAC;IAE1B,MAAM,YAAY,GAAG,QAAQ,CAAC,YAAY,CAAC;IAC3C,MAAM,WAAW,GAAG,QAAQ,CAAC,WAAW,CAAC;IACzC,MAAM,MAAM,GAAG,QAAQ,CAAC,OAAO,CAAC,GAAG,CAAC;IACpC,MAAM,QAAQ,GAAG,QAAQ,CAAC,OAAO,CAAC,KAAK,CAAC;IACxC,MAAM,SAAS,GAAG,QAAQ,CAAC,OAAO,CAAC,MAAM,CAAC;IAC1C,MAAM,OAAO,GAAG,QAAQ,CAAC,OAAO,CAAC,IAAI,CAAC;IACtC,MAAM,cAAc,GAAG,QAAQ,CAAC,cAAc,CAAC;IAC/C,MAAM,aAAa,GAAG,QAAQ,CAAC,aAAa,CAAC;IAC7C,MAAM,YAAY,GAAG,QAAQ,CAAC,YAAY,CAAC;IAC3C,MAAM,WAAW,GAAG,QAAQ,CAAC,WAAW,CAAC;IACzC,MAAM,aAAa,GAAG,QAAQ,CAAC,UAAU,CAAC;IAC1C,MAAM,cAAc,GAAG,QAAQ,CAAC,WAAW,CAAC;IAC5C,MAAM,SAAS,GAAG,QAAQ,CAAC,OAAO,CAAC,IAAI,KAAK,MAAM,GAAG,CAAC,GAAG,CAAC,CAAC;IAE3D,IAAI,QAAQ,CAAC,UAAU,KAAK,cAAc,EAAE;QAC1C,MAAM,IAAI,KAAK,CACX,kEAAkE;YACIE,GAAG,QAAQ,CAAC,UAAU,+BAA+B,CAAC,CAAC;KAC5D;IAED,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,CAAC,QAAQ,EAAE,SAAS,CAAC,CAAC;IAC7D,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IACnD,mBAAmB,CACf,GAAG,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,EAAE,CAAC,CAAC,CAAC,CAAC,CAAC,EAAE,QA AQ,EAAE,YAAY,EAC/D,WAAW,EAAE,MAAM,EAAE,QAAQ,EAAE,SAAS,EAAE,OAAO,EAAE,SAAS,EAC5D,cAAc,EAAE,aAAa,EAAE,YAAY,EAAE,WAAW,EAAE,aAAa,EACvE,cAAc,EAAE,KAAK,CAAC,CAAC;IAC3B,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,MAAM,2BAA2B,GAAiB;IACvD,UAAU,EAAE,qBAAqB;IACjC,WAAW,EAAE,MAAM;IACnB,SAAS,EAAEA,OAAK;IACbB,UAAU,EAAE,eAAmC;CAChD;;AC7GD;,,,,,;,,,;AAoBO,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC;;ACpBnE;,,,,,;AAoBA,MAAMI,uBAAqB,GAAG,KAAK,CAAC;AAC7B,MAAM,WAAW,GACpB,wBAAwB,CAAC,KAAK,EAAEA,uBAAqB,EAAE,MAAM,CAAC;;ACtBlE;,,,,,;AAoBO,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,EAAE,SAAS,CAAC;;ACpB9E;,,,,,;SAsBgB,UAAU,CAAC,IAI1B;IACC,MAAM,EAAC,MAAM,EAAE,KAAK,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,KAAK,EAAC,GAAG,MAAM,CAAC;IACvB,MAAM,EAAC,GAAG,EAAC,GAAG,KAAK,CAAC;IAEpB,MAAM,SAAS,GAAG,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC;IACrC,MAAM,QAAQ,GAAG,KAAK,CAAC,KAAK,CAAC,KAAK,EAAE,CAAC;IACrC,IAAI,IAAI,GAAG,GAA G,CAAC;IACf,IAAI,GAAG,GAAG,CAAC,EAAE;;QAEX,IAAI,CAAC,MAAM,CACP,EAAE,SAAS,GAAG,CAAC,CAAC,IAAI,GAAG,EACvB,MAAM,iCAaiC,EAAG,SAAS,GAAG,CAAC,CAAC,KACpD,SAAS,GAAG,CAAC,CAAC;QACtB,IAAI,GAAG,SAAS,GAAG,GAAG,GAAG,CAAC,CAAC;KAC5B;IACD,QAAQ,CAAC,MAAM,CAAC,IAAI,EAAE,CAAC,EAAE,CAAC,CAAC,CAAC;IAE5B,OAAO,OAAO,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,KAAK,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,QAAQ,EAAC,EAAC,CAAC,CAAC;AAC1E,CAAC;AAEM,MAAM,gBAAgB,GAAiB;IAC5C,UAAU,EAAE,UAAU;IACtB,WAA W,EAAE,MAAM;IACnB,UAAU,EAAE,UAA8B;CAC3C;;ACnDD;,,,,,;SAsBgB,IAAI,CAAC,IAA8C;IACjE,MAAM,EAAC,KAAK,EAAE,EAAC,KAAK,EAAE,KAAK,EAAE,KAAK,EAAC,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;IACrD,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,KAAK,EAAE,KAAK,CAAC,CAAC;IAC7C,MAAM,OAAO,GAAG,OAAO,CAAC,kBAakB,CAAC,GAAG,CAAC,CAAC;IACbD,OAAO,CAAC,IAAI,CAAC,KAAe,CAAC,CAAC;IAC9B,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,MAAM,UAAU,GAAiB;IACtC,UAAU,EAAE,IAAI;IACbB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,IAAwB;CACrC;;ACICD;,,,,,;AAqBA,IAAI,iBAE2C,CAAC;AAEHd,SAASJ,OAAK,CAAC,OAAoB;IACjC,iBAaiB,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,aAAa,EAAE,IAAI,aAAa;QACrE,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACT,CAAC,CAAC;AACL,CAAC;SAEe,aAAa,CACzB,IAAyD;IAC3D,MAAM,EAAC,MAAM,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;IAC/B,MAAM,EAAC,KAAK,EAAC,GAAG,MAAM,CAAC;IAEvB,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,KAAK,CAAC,KAAK,EAAE,KAAK,CAAC,KAAK,CAAC,CAAC;IACzD,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IACvD,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,MAAM,CAAC,KAAK,EAAE,WAAW,EAAE,UAAU,EAAE,

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MAAM,mBAAmB,GAAiB;IAC/C,UAAU,EAAE,aAAa;IACzB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,aA  
AiC;IAC7C,SAAS,EAAEA,OAAK;CACjB;;ACzDD;,,,,,,,,,,,,;AAmBO,MAAM,WAAW,GAAiB,uBAAuB,CAA  
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```
=====\n*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from\n './Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\n function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend: BackendWasm,\n attrs: BatchMatMulAttrs\n }) {\n const { inputs, backend, attrs } = args;\n const { a, b } = inputs;\n const { transposeA, transposeB } = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n `BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input batch dimensions must either be the\n same or at least one input batch dimension must be 1. Got input\n batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =\n outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and\n (${innerShapeB}) of Tensors with shapes\n ${a.shape} and\n ${b.shape} and transposeA=${transposeA}\n and transposeB=${transposeB}\n must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,\n innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the implementation is designed to operate on rank-3 tensors\n const a3d = reshape({ inputs: { x: a }, backend, attrs: { shape: a3dShape });\n const b3d = reshape({ inputs: { x: b }, backend, attrs: { shape: b3dShape });\n\n const a3dId = backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n b3d.shape.length, transposeA, transposeB,
```



```

batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', //
newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number'
// outId\n]);\n}\n\nfunction resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n
attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n\n const {images} = inputs;\n
const {alignCorners, halfPixelCenters, size} = attrs;\n const [newHeight, newWidth] = size;\n\n const
[batch, oldHeight, oldWidth, numChannels] = images.shape;\n const outShape = [batch, newHeight, newWidth,
numChannels];\n\n let xData = backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !==
'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc:
resizeBilinear as {} as KernelFunc\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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No license file was found, but licenses were detected in source scan.

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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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C","sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under
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```

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```
* =====\n*\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n}}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cosh.js.map
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```

```
=====\n*\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { rangeImplCPU } from './kernel_utils/shared';\nexport const range =\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } = args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n const out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n}}
```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Range.js.map
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No license file was found, but licenses were detected in source scan.

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language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LogicalAnd.js.map

No license file was found, but licenses were detected in source scan.

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```

```
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n 'number', // dtype\n // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n\nfunction gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): \nTensorInfo {\n const {backend, inputs} = args;\n const {params, indices} = inputs;\n\n const [resultShape,
numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params, indices);\n\n const out =
backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return out;\n }\n\n const
indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData =
backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmGatherNd(\n xId,
 CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize, \n stridesBytes, outId);\n\n return
out;\n\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n\n
setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n}}}
```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n =====\n\n *\n\n \n\n import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n \n\n import {BackendWasm} from './backend_wasm';\n\n \n\n export function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm})\n {\n const {inputs, attrs} = args;\n const {x} = inputs;\n const {shape} = attrs;\n\n const xSize =
util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and
```



```
old`+\n `shape must have the same number of elements.`);\n\n // Backend needs to track refCount for the
dataId for reshape op\n args.backend.incref(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as {} as KernelFunc\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.js.map

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```
=====\n*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { concatImplCPU } from '../kernel_utils/shared';\nimport { identity } from './Identity';\nimport { reshape } from './Reshape';\n\nexport function concat(\n args: { inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs }) {\n const { inputs, backend } = args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return identity({ inputs: { x: $inputs[0] }, backend });\n }\n\n const out = backend.makeOutput(outShape, inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes = $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype === 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({ inputs: { x: t }, backend, attrs: { shape } });\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return { vals: backend.readSync(t.dataId), shape: t.shape }; \n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype, simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes = backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims = 0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input => backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out); for (let b = 0; b <
```

```

batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const
innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n}
\n return out;\n}\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName:
'wasm',\n kernelFunc: concat as { } as KernelFunc,\n};\n}}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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ACtC,SAAS,EAAE,KAAK;CACjB,CAAC","sourcesContent":["/**\n

```

```

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```

```

=====\n
*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number,
offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect =
backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId =
backend.dataIdMap.get(t.dataId).id;\n const eId = backend.dataIdMap.get(e.dataId).id;\n const out =
backend.makeOutput(t.shape, t.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const cRank =
condition.shape.length;\n const tRank = t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1
?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return

```

```
out;\n}\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { } as KernelFunc,\n setupFunc: setup\n};\n"}\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Select.js.map

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\* =====\*/

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Ceil.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Elu.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Elu.h

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Transform.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Tan.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Cosh.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/elu\_impl.h

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/sin\_cos\_workaround.h

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Any.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/elu\_impl.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/All.cc

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/MirrorPad.cc

\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/sin\_cos\_workaround.cc

No license file was found, but licenses were detected in source scan.

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```

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```
=====\n*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType { float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4}\n\n// Must match enum in cc/fusable_activations.h.\nexport enum FusableActivation { linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu = 6}\n\n}}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.js.map

No license file was found, but licenses were detected in source scan.

```
{"version":3,"file":"RealDiv.js","sourceRoot":"","sources":["../../src/kernels/RealDiv.ts"],"names":[],"mappings":"AAA;,,,,,;GAeG;AAEH,OAAO,EAAe,OAAO,EAAC,MAAM,uBAAuB,CAAC;AAE5D,OAAO,EAAC,wBAwB,EAAC,MAAM,iBAAiB,CAAC;AAEzD,MAAM,qBAAqB,GAAG,IAAI,CAAC;AACnC,MAAM,CAAC,MAAM,aAAa,GACTB,wBAAwB,CAAC,OAAO,EAAE,qBAAqB,CAAC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\n * permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n}}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.js.map

No license file was found, but licenses were detected in source scan.

```
{"version":3,"file":"GreaterEqual.js","sourceRoot":"","sources":["../../src/kernels/GreaterEqual.ts"],"names":[],"mappings":"AAAA;,,,,,;GAeG;AACH,OAAO,EAAC,YAAy,EAAe,MAAM,uBAAuB,CAAC;AAEjE,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AAEzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,kBAAkB,GAC3B,wBAAwB,CAAC,YAAy,EAAE,qBAAqB,EAAE,MAAM,CAAC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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```
=====\n*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n}}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.js.map

No license file was found, but licenses were detected in source scan.

```
{ "version": 3, "file": "FusedBatchNorm.js", "sourceRoot": "", "sources": ["../src/kernels/FusedBatchNorm.ts"], "names": [], "mappings": "AAAA;:::;;:::;;GAeG;AAEH,OAAO,EAAC,cAAc,EAAMF,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAI5I,IAAI,aAEgE,CAAC;AAErE,SAAS,KAAK,CAAC,OAAoB;IACjC,aAAa,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAC9B,cAAc,EAAE,IAAI,CAAC,UAAU,EAC/B,CAAC,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE,QAAQ,CAAC,CAAC,CAAC;AAC9E,CAAC;AAED,SAAS,cAAc,CAAC,IAIvB;IACC,MAAM,EAAC,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,eAAe,EAAC,GAAG,KAAK,CAAC;IACuC,MAAM,EAAC,CAAC,EAAE,IAAI,EAAE,QAAQ,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,MAAM,CAAC;IACID,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,MAAM,MAAM,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IACrD,MAAM,UAAU,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,QAAQ,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC7D,MAAM,QAAQ,GAAG,MAAM,IAAI,IAAI,CAAC,CAAC,CAAC,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC,CAAC,CAAC,CAAC,CAAC;IAC9E,MAAM,OAAO,GAAG,KAAK,IAAI,IAAI,CAAC,CAAC,CAAC,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC,CAAC,CAAC,CAAC,CAAC;IAE3E,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACjD,oCAAoC;IACpC,IAAI,IAAI,CAAC,aAAa,CAAC,CAAC,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;QACrC,OAAO,GAAG,CAAC;KACZ;IAED,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,aAAa,CACT,GAAG,EAAE,MAAM,EAAE,UAAU,EAAE,QAAQ,EAAE,OAAO,EAAE,eAAe,EAAE,KAAK,CAAC,CAAC;IACxE,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,oBAAoB,GAAiB;IACuD,UAAU,EAAE,cAAc;IAC1B,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IACkB,UAAU,EAAE,cAAkC;CAC/C,CAAC", "sourcesContent": ["/*\n
```

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```

```
=====\n*\nimport { FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n
```

```
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number',\n 'number', 'number', 'number', 'number', 'number', 'number']);\n\nfunction fusedBatchNorm(args: {\n backend:\n BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const\n {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =\n inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =\n backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const\n offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?\n backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-\n circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId,\n varianceEpsilon, outId);\n return\n out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as { } as KernelFunc\n};\n\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-\nwasm/dist/kernels/FusedBatchNorm.js.map
```

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* =====
```

```
*/
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/test_node.ts
```

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.d.ts
```

```
*
```

```
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.js
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No license file was found, but licenses were detected in source scan.

```
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```
* =====\n*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sqrt.js.map

No license file was found, but licenses were detected in source scan.

```
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AI,CAAC;IACpC,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CA
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Ac,GAAiB;IAC1C,UAAU,EAAE,QAAQ;IACpB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,QAA4B;CACzC,
CAAC","sourcesContent":["/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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=====
```

```
*\n\nimport { Identity, IdentityInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nexport function identity(args: { inputs: IdentityInputs, backend: BackendWasm }):\n TensorInfo {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typeArrayFromHeap(x);\n const outVals = backend.typeArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as { } as KernelFunc,\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.js.map

No license file was found, but licenses were detected in source scan.

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M,0CAA0C,CAAC;AACnF,iDAAiD;AACjD,OAAO,EAAC,SAAS,IAAI,YAAY,EAAC,MAAM,0CAA0C,CAAC;
AAEnF,OAAO,EAAC,aAAa,EAAE,YAAY,EAAE,YAAY,EAAC,CAAC","sourcesContent":["/*\n * @license\n
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 limitations under the License.\n \*

```
=====
*\n\n// Import shared functionality from tfjs-backend-cpu without triggering\n\n// side effects.\n\n// tslint:disable-next-
line: no-imports-from-dist\nimport {concatImpl as concatImplCPU} from '@tensorflow/tfjs-backend-
cpu/dist/shared';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {sliceImpl as sliceImplCPU} from
 '@tensorflow/tfjs-backend-cpu/dist/shared';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {rangeImpl as
rangeImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';\n\n\nexport {concatImplCPU, rangeImplCPU,
sliceImplCPU};\n"}}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-  
 wasm/dist/kernel\_utils/shared.js.map

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```

=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n}) {\n const {inputs, attrs,
backend} = args;\n\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId
= backend.dataIdMap.get(filter.dataId).id;\n\n const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n const
$dilations = dilations === null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad,
dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad =
convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new
Error(\n `wasm backend DepthwiseConv2dNative does not support dataFormat:` +\n
`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n\n return out;\n }\n\n export const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n }\n}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthwiseConv2dNative.js.map

No license file was found, but licenses were detected in source scan.

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CAAC","sourcesContent":["/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Floor.js.map

No license file was found, but licenses were detected in source scan.

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AAWb;CACrC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy
of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function
cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n TensorInfo {\n const {inputs:
{x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals =
backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as {} as KernelFunc,\n};\n"]}
```



```

function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number',
 // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args:
{backend: BackendWasm, inputs: BinaryInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const
{a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =
backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,
outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return
out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =
new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n
 CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if
(supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const
aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =
backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>
v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&
loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting
along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n }\n\n"}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary\_kernel.js.map

No license file was found, but licenses were detected in source scan.

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2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a  
copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable  
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the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet
wasmAny: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number,
number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs }):\n TensorInfo
{\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as { } as KernelFunc\n};\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Any.js.map

No license file was found, but licenses were detected in source scan.

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AC,CAAC", "sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
* =====\n*\nimport { KernelConfig, Round } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
```

```
./unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n"]}]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Round.js.map
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No license file was found, but licenses were detected in source scan.

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","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
* =====\n *\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
./unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n"]}]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js.map
```

No license file was found, but licenses were detected in source scan.

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{"version":3,"file":"Exp.js","sourceRoot":"","sources":["../../src/kernels/Exp.ts"],"names":[],"mappings":"AAAA;;;
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *
* =====\n *\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
./unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"]}]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.js.map
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No license file was found, but licenses were detected in source scan.

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```
=====\n*\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n}}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.js.map

No license file was found, but licenses were detected in source scan.

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```
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```



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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { identity } from\n './Identity';\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array,\n axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction\n setup(backend:\n BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', //\n axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', // out_shape_length\n 'number' //\n out_id\n]);\n\n next export function reverse(\n args: {inputs: ReverseInputs, backend: BackendWasm, attrs:\n ReverseAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} =\n attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length === 0) {\n return\n identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const axesBytes =\n new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n backend.disposeData(out.dataId);\n return reshaped;\n }\n\n next export const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:\n setup\n };}\n\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reverse.js.map

No license file was found, but licenses were detected in source scan.

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```

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```
=====
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number',\n // iouThreshold\n 'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n\n function
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold,\n maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from
the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32',\n pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32',\n pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n }\n\n export const
nonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as KernelFunc,\n };
}
```

Found in path(s):

`*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.js.map`

No license file was found, but licenses were detected in source scan.

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AC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n * =====
*\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n]}]
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu6.js.map

No license file was found, but licenses were detected in source scan.

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```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppression\_util.js.map

No license file was found, but licenses were detected in source scan.

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```

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n\n function mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n }) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n wasmMirrorPad(xId, xShapeBytes, x.shape.length, CCppType[x.dtype], prePaddingsBytes, postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n }\n\n export const mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc: setup\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MirrorPad.js.map

No license file was found, but licenses were detected in source scan.

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```
* =====\n*\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);"} }
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.js.map

No license file was found, but licenses were detected in source scan.

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```

```
===== \n*\nimport './register_all_kernels';\nexport\n * from './base';"} }
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index.js.map

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```
=====\n*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from './backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId:
number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n
```

```

'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number',
 // outId\n]);\n\nfunction fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n const fusedActivation =\n FusableActivation[activation as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `_${activation}_\n activation not yet supported for FusedDepthwiseConv2D` +\n `_in the wasm backend.`);\n }\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const outputChannels = convInfo.outChannels;\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedDepthwiseConv2D only supports rank-1 bias but got` +\n `_rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape\n (${biasData.shape}) does not` +\n `_match the number of output channels (${outputChannels}).`);\n }\n biasId = biasData.id;\n }\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support dataFormat:` +\n `_${dataFormat}. Please use 'NHWC'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n wasmFusedDepthwiseConv2d(\n xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.js.map

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```
=====
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'.binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n}}
```

Found in path(s):

`/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.js.map`

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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Ceil.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/All.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Tan.ts  
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/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transform.d.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.js  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Ceil.d.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cosh.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.d.ts  
\*

/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cosh.js

No license file was found, but licenses were detected in source scan.

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions
and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.js.map

No license file was found, but licenses were detected in source scan.

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the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let
inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are
done.\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as KernelFunc\n };
 }
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Min.js.map

No license file was found, but licenses were detected in source scan.

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AAW,EAAE,MAAM;IACnB,UAAU,EAAE,UAA8B;CAC3C,CAAC", "sourcesContent":["/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.js.map

No license file was found, but licenses were detected in source scan.

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```

```
=====\n*\n\n// Register the wasm backend.\nimport './index';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {setTestEnvs} from '@tensorflow/tfjs-core/dist/jasmine_util';\nimport jasmine from 'jasmine';\n\nError.stackTraceLimit = Infinity;\n\nprocess.on('unhandledRejection', e => {\n throw e;\n});\n\nsetTestEnvs([\n { name: 'wasm-node', backendName: 'wasm', isDataSync: true }\n]);\n\nconst runner = new
```

```
jasmine({});\nrunner.loadConfig({spec_files:
 ['src/**/*.test.ts'], random: false});\n\nif (process.env.JASMINE_SEED) {\n runner.seed(process.env.JASMINE_SEED);\n}\n\nrunner.execute();\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test\_node.js.map  
No license file was found, but licenses were detected in source scan.

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 C","sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under
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 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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 License.\n *
 * =====\n *\n *\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.js.map  
No license file was found, but licenses were detected in source scan.

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 License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
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 License.\n *
 * =====\n *\n *\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.js.map  
No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number)\n=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n\n function kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n\n return selectedIndicesTensor;\n }\n\n export const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as KernelFunc,\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.js.map

No license file was found, but licenses were detected in source scan.

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```
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the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*/\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast}
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest
= 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n
'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n
'number' // out id\n]);\n}\n\nfunction cropAndResize(args: {\n backend: BackendWasm,\n inputs:
CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {method, extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} = inputs;\n\n const
```





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or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*

```
=====\n*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n 'number',
 // outId\n]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs:
DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const
outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =
inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,
outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const
out = backend.makeOutput(outputShape, 'float32');\n const xData = backend.dataIdMap.get(x.dataId);\n const
xId = xData.id;\n const
```

```
xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const\n outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);\n\n const outStridesBytes =\n new\n Uint8Array(new Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n\n wasmDepthToSpace(\n xId, blockSize, channelsLast, xStridesBytes, x.shape.length - 1,\n outputShapeBytes,\n outStridesBytes, outputShape.length, outId);\n\n return out;\n}\n\n\nexport const depthToSpaceConfig: KernelConfig\n = {\n kernelName: DepthToSpace,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as\n {} as KernelFunc\n};\n\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthToSpace.js.map
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No license file was found, but licenses were detected in source scan.

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```

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,SAAS,EAAE,KAAK;IAChB,UAAU,EAAE,YAAgC;CAC7C,CAAC", "sourcesContent": ["/\*\*\n

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the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs,
 StridedSliceInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
 './backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array, xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array,
 stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength:
 number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStridedSlice =
 backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', //
 xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n\n export function
 stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { x } = inputs;\n const
 {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape,
 begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({ inputs: { x }, backend, attrs:
 { shape: finalShape } });\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
 ${x.shape.length}`);\n const
 size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice),
 we min(begin, end).\n const sliced = slice({ inputs: { x }, backend, attrs: { begin: $begin, size } });\n result =\n reshape({ inputs: { x: sliced }, backend, attrs: { shape: finalShape } });\n backend.disposeData(sliced.dataId);\n } else
 {\n const out = backend.makeOutput(finalShapeSparse, 'float32');\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new Uint8Array(new
 Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
 Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
 stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const outputShapeBytes =\n new
 Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n new
 Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStridedSlice(\n xId, xStridesBytes,
 x.shape.length, beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes,
 finalShapeSparse.length, outId);\n result = reshape({ inputs: { x: out }, backend, attrs: { shape: finalShape } });\n backend.disposeData(out.dataId);\n }\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as
 KernelFunc\n};\n\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/StridedSlice.js.map

No license file was found, but licenses were detected in source scan.

```
{ "version":3,"file":"tf-backend-wasm.es2017.min.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/Maximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts","../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_util.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSuppressionV5.ts","../src/kernels/NotEqual.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pack.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/Range.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Softmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts","../src/kernels/SquaredDifference.ts","../src/kernels/Step.ts","../src/kernels/StridedSlice.ts","../src/kernels/Sub.ts","../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../src/kernels/TopK.ts","../src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../src/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-wasm.js","../src/backend_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js","../src/base.ts","../src/version.ts"],"sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * \n * =====\n * \n * This enum must align with the enum defined in cc/backend.h.\n * export enum CppDType {\n * float32 = 0,\n */
```

int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable\_activations.h.\nexport  
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu  
= 6\n}\n", /\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache  
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permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusableActivation } from
 './types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,
 biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
 null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', //
 b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', //
 activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' // out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:
 BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const { inputs, backend, attrs } = args;\n const { a, b, bias,
 preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB,
 activation, leakyreluAlpha } = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
 backend.dataIdMap.get(b.dataId).id;\n let biasId = 0;\n if (bias !== null)\n {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new
 Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 : \n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation = \n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw
 new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :
 b.shape[2];\n const batchDim = a.shape[0];\n const out = backend.makeOutput([batchDim, leftDim, rightDim],
 a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
 Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new
 Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes,
 b.shape.length,\n transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return out;\n }\n\n export const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as
 { } as KernelFunc\n }; \n }, /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
```

```

*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs});\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
 const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n }\n }"/**\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====
*\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n }"/**\n * @license\n
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs:
BinaryInputs});\n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId =
backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType =
dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n
if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype ===
'float32') {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims =
backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =

```

```

backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>
v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&
loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting
along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n}\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const
{inputs, backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds =
inputs.map(x => backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law
or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n}

```

kernelFunc: identity as { } as KernelFunc,\n};\n"/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { identity } from\n './Identity';\nimport\n { CppDType } from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength:\n number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction\n setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n\n export function transpose(\n args:\n { inputs:\n TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs }):\n TensorInfo {\n const { inputs, backend,\n attrs } = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,\n attrs.perm);\n\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n\n if (permIsNoOp) {\n const\n cloned = identity({ inputs, backend });\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =\n backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId,\n xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return\n out;\n }\n\n function\n computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new\n Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n }\n\n function\n removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i =\n 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if\n (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape, newPerm];\n }\n\n export const transposeConfig:\n KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as { } as\n KernelFunc,\n setupFunc: setup,\n };\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use\n * this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n '../backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose\n * if necessary.\n * \n * Used by reduction ops.\n * \n * @param x input TensorInfo\n * @param axis reduction axes\n *
```



```

@param backend wasm backend instance\n\nexport function permuteAxesAndTranspose(\n x: TensorInfo,\n axis:\n number|number[], backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes:\n number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes =\n backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if\n (permutedAxes != null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i <\n newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n\n axes =\n backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:\n permutedAxes}, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =\n backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n\n return {transposed:\n xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n * =====\n\n * \n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n {permuteAxesAndTranspose}\n from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction\n setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,\n number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}): TensorInfo {\n\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,\n inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all',\n axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,\n axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,\n x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return\n out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: all as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *\n * =====\n
```

```

*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
 { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
 number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
 null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
 attrs: AnyAttrs }):\n TensorInfo {\n const { backend,
 inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
 inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
 transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
 axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
 (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
 backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
 backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
 out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
 setup,\n kernelFunc: any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
 Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
 except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the
 License.\n *
=====\n
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
 './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
 number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, ['number', // x_id\n 'number', // dtype\n
 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:
 { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n
 const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n
 let inputId = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n
 permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
 backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
 will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n
 }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
 outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
 innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n}\n\n if
 (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
 }\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
 'wasm',\n

```

kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmAvgPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const channels = convInfo.inChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(`wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please use 'channelsLast'.`);\n }\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(`wasm backend only supports average pooling with dilation = [1, 1],`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nexport function reshape(\n args: { inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n const { inputs, attrs } = args;\n const { x } = inputs;\n const { shape } = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
```

```

`new shape: ${$shape}, old shape: ${x.shape}. New shape and old `+`n `shape must have the same number of
elements.`);`n`n // Backend needs to track
refCount for the dataId for reshape op`n args.backend.incRef(x.dataId);`n return {dataId: x.dataId, shape: $shape,
dtype: x.dtype};`n`n`nexport const reshapeConfig: KernelConfig = {`n kernelName: Reshape,`n backendName:
'wasm',`n kernelFunc: reshape as {} as KernelFunc`n};`n"/**`n * @license`n * Copyright 2019 Google LLC. All
Rights Reserved.`n * Licensed under the Apache License, Version 2.0 (the "License");`n * you may not use this
file except in compliance with the License.`n * You may obtain a copy of the License at`n *`n *
http://www.apache.org/licenses/LICENSE-2.0`n *`n * Unless required by applicable law or agreed to in writing,
software`n * distributed under the License is distributed on an "AS IS" BASIS,`n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.`n * See the License for the specific language
governing permissions and`n * limitations under the License.`n *
=====`n
*/`n`nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';`n`nimport {BackendWasm} from '../backend_wasm';`n`nimport {reshape} from
'./Reshape';`n`nlet wasmBatchMatMul: (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,`n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,`n transposeB: boolean, outId: number) =>
void;`n`nfunction setup(backend: BackendWasm) {`n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [`n 'number', // a_id`n 'array', // a_shape`n 'number', // a_shape.length`n 'number', // b_id`n
'array', // b_shape`n 'number', // b_shape.length`n 'number', // transpose_a`n 'number', // transpose_b`n
'number' // out_id`n `]);`n`nfunction batchMatMul(args: {`n inputs: BatchMatMulInputs,`n backend:
BackendWasm,`n attrs: BatchMatMulAttrs`n}) {`n const {inputs, backend, attrs} = args;`n const {a, b} = inputs;`n
const {transposeA, transposeB} = attrs;`n`n if (a.dtype !== 'float32' || b.dtype !== 'float32') {`n throw new
Error(`n `BatchMatMul for non non-float32 tensors not yet supported.`);`n `}`n`n const aRank =
a.shape.length;`n const bRank = b.shape.length;`n`n const innerShapeA = transposeA ? a.shape[aRank - 2] :
a.shape[aRank - 1];`n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];`n`n const
outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];`n const outerShapeB = transposeB ?
b.shape[bRank - 2] : b.shape[bRank - 1];`n`n const outerDimsA = a.shape.slice(0, -2);`n const outerDimsB =
b.shape.slice(0, -2);`n`n const batchDimA = util.sizeFromShape(outerDimsA);`n const batchDimB =
util.sizeFromShape(outerDimsB);`n`n const batchDimsCompatible =`n batchDimA === batchDimB ||
batchDimA === 1 || batchDimB === 1;`n`n util.assert(`n aRank >= 2 && bRank >= 2 &&
batchDimsCompatible,`n `() => `Error in matMul: the input batch
dimensions must either be the `+`n `same or at least one input batch dimension must be 1. Got input `+`n
`batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);`n`n const outShapeOuterDims =`n batchDimA
> batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);`n`n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);`n`n util.assert(`n innerShapeA === innerShapeB,`n
() => `Error in matMul: inner shapes (${innerShapeA}) and (`+`n ``${innerShapeB}) of Tensors with shapes
${a.shape} and `+`n ``${b.shape} and transposeA=${transposeA}`+`n ` and transposeB=${transposeB}
must match.`);`n`n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :`n
[batchDimA, outerShapeA, innerShapeA];`n`n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :`n [batchDimB, innerShapeB, outerShapeB];`n`n // The rest of the
implementation
is designed to operate on rank-3 tensors`n`n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape:
a3dShape}});`n`n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});`n`n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;`n`n const b3dId = backend.dataIdMap.get(b3d.dataId).id;`n`n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];`n`n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];`n`n const
batchDim = Math.max(batchDimA, batchDimB);`n`n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);`n`n const outId = backend.dataIdMap.get(out.dataId).id;`n`n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);`n`n const bShapeBytes = new Uint8Array(new

```







```

number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n } }\n\nreturn out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride:\n number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let\n outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n\n const endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction\nslice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:\n backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let\n outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =\n beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <\n endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,\n xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:\n backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:\n backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number,\n number]): void {\n let\n outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK =\n begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k\n = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\n}\n\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc:\n slice as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use\n this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *

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=====\n\n*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,\n KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction\n batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:\n BatchToSpaceNDAttrs\n}) {\n const\n {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n\n const prod =\n blockShape.reduce((a, b) => a * b);\n\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:\n {x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,\n attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,\n attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n attrs: {begin: sliceBeginCoords,\n size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig:\n KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as\n {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the

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```
=====\n*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm};\n tensorInfo: TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n })\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
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```
=====\n*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from '../unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as KernelFunc\n }; \n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
```

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```

=====
*/
import { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import { concatImplCPU } from
'./kernel_utils/shared';
import { identity } from './Identity';
import { reshape } from './Reshape';
export function
concat(
 args: { inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs }
) {
 const { inputs, backend }
= args;
 const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];
 let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);
 // Keep only non-empty tensors (ignore tensors
with 0 in their shape).
 const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
 if ($inputs.length
=== 1) {
 return identity({ inputs: { x: $inputs[0] }, backend });
 }
 const out =
backend.makeOutput(outShape, inputs[0].dtype);
 if (util.sizeFromShape(outShape) === 0) {
 return out;
 }
 const shapes = $inputs.map(t => t.shape);
 backend_util.assertParamsConsistent(shapes, axis);
 if
($inputs[0].dtype === 'string') {
 // Any concat of n-dimensional tensors across any axis can be reduced to a
concatenation of two-dimensional tensors across the axis 1 by first
// partitioning the axes of the original tensors
into those less than the
// axis to be concatenated and the rest. Then reshape the tensors
// into a two-
dimensional tensor by collapsing these two sets of axes and
// concatenate the resulting matrices across the axis
1, finally reshaping
// the result to have the proper shape.
 const inputs2D = $inputs.map(t => {
 const
innerSize = util.sizeFromShape(t.shape.slice(axis));
 const shape = [-1, innerSize];
 return reshape({ inputs: { x: t }, backend, attrs: { shape } });
 });
 const inputsValShapes = inputs2D.map(t
=> {
 return { vals: backend.readSync(t.dataId), shape: t.shape };
 });
 // Concat 2d tensors along
axis=1.
 outShape =
 backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);
 const
simplyConcat = inputs2D[0].shape[0] === 1;
 const outVals = concatImplCPU(
inputsValShapes, outShape, inputs[0].dtype,
 simplyConcat) as string[];
 const finalOutShape
=
 backend_util.computeOutShape($inputs.map(t => t.shape), axis);
 out.shape = finalOutShape;
 const outData = backend.dataIdMap.get(out.dataId);
 outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);
 inputs2D.forEach(t => backend.disposeData(t.dataId));
 }
 return out;
}
const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));
let sumInnerDims
= 0;
const innerDims = $inputs.map(input => {
 const innerDim =
util.sizeFromShape(input.shape.slice(axis));
 sumInnerDims += innerDim;
 return innerDim;
});
const
inVals = $inputs.map(input => backend.typedArrayFromHeap(input));
const outVals =
backend.typedArrayFromHeap(out);
for (let b = 0; b < batchDim; b++) {
 let outOffset = b * sumInnerDims;
 for (let i = 0; i < inVals.length; i++) {
 const innerDim = innerDims[i];
 const inOffset = b * innerDim;
 const vals = inVals[i].subarray(inOffset, inOffset + innerDim);
 outVals.set(vals, outOffset);
 outOffset +=
innerDim;
 }
}
return out;
}
export const concatConfig: KernelConfig = {
 kernelName: Concat,
 backendName: 'wasm',
 kernelFunc: concat as { } as KernelFunc,
};
/*
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*
=====
*/
import { backend_util, util } from '@tensorflow/tfjs-core';
export function concatImpl(inputs, outShape, dtype,
simplyConcat) {
 const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));
 if
(simplyConcat && dtype !== 'string') {
 // Use built-in TypedArray.set() method for speed.
 let offset =
0;
 inputs.forEach(input => {
 const size = util.sizeFromShape(input.shape);
 outVals.set(input.vals,

```



cGUpKTtcbLxulCBpZiAoc2ltcGx5Q29uY2F0ICYmIGR0eXBIIICE9PSAnc3RyaW5nJyke1xuICAgIC8vIFVzZSBi  
dWlsdC1pbiBUeXBIZEFycmF5LnNldCgpIG1ldGhvZCBmb3Igc3BIZWQuXG4gICAgbGV0IG9mZnNldCA9IDA  
7XG4gICAgYW5wdXRzLmZvcVhY2goaW5wdXQgPT4ge1xuICAgICAgY29uc3Qgc2l6ZSA9IHV0aWwuc2l6Z  
UZyb2l1TaGFwZShpbN1dC5zaGFwZSk7XG5cbiAgICAgIChvdXRWYWxzIGFzIFR5cGVkQXJyYXkpbNldCh  
pbnB1dC52YWxzIGFzIFR5cGVkQXJyYXksIG9mZnNldCk7XG4gICAgICBvZmZzZXQgKz0gc2l6ZTtcbiAgICB  
9KTtcbiAgfSB1bHNIIHtcbiAgICBsZXQgY29sT2Zmc2V0ID0gMDtcbLxulCAgIGlucHV0cy5mb3JFYWNoKGluc  
HV0ID0+IHtcbiAgICAgIGNvbnN0IGRIY29kZWREYXRhID0gZHR5cGUgPT09ICdzdHJpbmcmID9cbiAgICAgI  
CAgICBiYWNrZW5kX3V0aWwuc2l6ZS1vbnVpbN1dC52YWxzIGFzIFVpbN1dC52YWxzIGFzIFVpbN1dC52YWxz  
JyYXlbXSkgOlxuICAgICAgICAgICAgICglucHV0LnZhbmHMgYXMgVHlwZWRBcnJheTtcbLxulCAgICAgbGV0IHRJZ  
HggPSAwO1xuXG4gICAgICBmb3IgcGgldCB5b3cgPSAwOyByb3cgPCBpbN1dC5zaGFwZVswXTsgKytYb3cp  
IHtcbiAgICAgICAgY29uc3QgcmlvS29kZWREYXRhW3RjZWh3RjZHRK107XG4gICAgICAgICAgIH1cbiA  
gICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAg  
mV0dXJlIG91dFZhbHM7XG55XG4iXX0=","/\*\*\n

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the specific language governing permissions and\n \* limitations under the License.\n \*

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```
*\n\nimport { backend_util,
 Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmConv2d: (\n xId: number, batchSize:
number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,
padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels:
number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', //
//
 padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:
Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n if
```

```
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support\n dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =\n backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth, padTop,\n padRight, padBottom, padLeft, isSamePad,\n dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n }\n\nexport\nconst conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport\n {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,\n KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n import {BackendWasm} from\n './backend_wasm';\n\n let wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,\n filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,\n topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:\n number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\n function setup(backend:\n BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n]);\n\n function conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs:\n Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n }): TensorInfo {\n const {backend, inputs,\n attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,\n dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n const $dataFormat =\n backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n inputShape, filter.shape as [number, number, number, number],\n strides,\n dilations, pad, dimRoundingMode,\n false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =\n convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -\n convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =\n util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,\n fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =\n isChannelsLast\n ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const xChannelStride =\n isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride = isChannelsLast ?\n dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride =
```

```

isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId
= backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport
const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig }
from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig =
createUnaryKernelConfig(Cosh);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum
InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number,
boxesId: number, boxIndId: number, numBoxes: number,\n imagesShape: Uint8Array, cropHeight: number,
cropWidth: number,\n method: number, extrapolationValue: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null
/*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n
'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n
'number', // extrapolation value\n 'number' // out id\n]);\n\nfunction cropAndResize(args: {\n backend:
BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image,
boxes, boxInd} = inputs;\n const numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as
[number, number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData =

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backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n
InterpolationMethod[method as { } as keyof typeof InterpolationMethod],\n
 extrapolationValue, outId);\n\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n
return out;\n}\n\nexport const cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cropAndResize as { } as KernelFunc\n};\n\n"/**\n *
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copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} from
 './types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n
'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n
'number' // dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\n\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n util.assert(x.dtype
=== 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM
backend`);\n // permute required axis to inner most axis\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n
const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation
!== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out =
transpose(\n {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n }\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: cumsum as { } as KernelFunc\n};\n\n"/**\n *
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n

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* limitations under the License.
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n
]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n
attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const
{blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const outputHeight = inputHeight *
blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize *
blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth,
outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out =
backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId =
xData.id;\n const xStridesBytes
 =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth:
 number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n
outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /*void*/, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //

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inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\nfunction
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs: DepthwiseConv2dNativeAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n const
$dilations = dilations == null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad,
dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n
 const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels
= convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend DepthwiseConv2dNative
does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"/**\n * @license\n *
=====\n
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/**\n *
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License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from
'/Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const
[input] = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape =
input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n
util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n
inputRank}]);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n
kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out =
backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as
number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName:
'wasm',\n kernelFunc: fill as {} as KernelFunc,\n};\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch:
number, imageHeight: number, imageWidth: number,\n numChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight =
backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', //
imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport
function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const
{inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape,

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image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n
return out;\n)\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight
 as { } as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
@license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) ===
0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmBatchNorm(\n xId,
meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const

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```
fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
```

```
=====\n
*/\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,
padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,
dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n
inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number,
leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /*
void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n
'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number',
// preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n
dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof
FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet
supported for FusedConv2D ` +\n ` in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedConv2D only supports rank-1 bias but got ` +\n ` rank ${biasData.shape.length}.`);\n }\n if
(biasData.shape[0] !== outputChannels)
{\n throw new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n ` match the
number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const
inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend
FusedConv2D does not
```

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support dataFormat:" +\n `${dataFormat}'. Please use 'NHWC.');\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number,
filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom:
number,\n padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number,
strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation:
number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n
'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n
]);\n\nfunction fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend:
BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x,
filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation
as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedDepthwiseConv2D bias shape\n (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n

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const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights
== null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n
wasmFusedDepthwiseConv2d(\n xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n
biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight,
strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0,
outId);\n\n return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:
FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as
{} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const
{params, indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,
params.dtype);\n\n if (numSlices === 0) {\n return out;\n }\n\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId =
indicesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n
stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName:
GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig,
KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any
index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals =
backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i <
indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >=
0,\n () =>\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const
shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n
backend\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length
- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n
backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape = shapeInfo.outputShape;\n return
out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
=====

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governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n *^\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }\nfrom './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n\n *^\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from\n './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,\n null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //\n out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n backend: BackendWasm\n }):\n TensorInfo {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either\n float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)\n !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,\n outId);\n }\n\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {\n } as KernelFunc\n };\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n\n *^\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n\n *^\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
```



OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n *\\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\n * \\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n *\\nimport {KernelConfig, LogicalAnd}\n from '@tensorflow/tfjs-core';\n\\nimport {createBinaryKernelConfig} from './binary_kernel';\n\\nconst\n supportsFullBroadcast = false;\n\\nexport const logicalAndConfig: KernelConfig =\n createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\\n", /**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\n * \\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n *\\n\\nimport {backend_util,\n KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\\nimport\n {BackendWasm} from './backend_wasm';\n\\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\\nimport\n {CppType} from './types';\n\\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)\n =>\\n void;\n\\nfunction setup(backend: BackendWasm): void {\\n wasmMax = backend.wasm.cwrap(Max, null\n /*void*/, [\\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\\n\\nfunction max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\\n TensorInfo {\\n\n const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\\n const {transposed, axes,\n originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\\n if\n (inputWasTransposed)\n {\\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\\n\\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',\n axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n }\\n\\n if (inputWasTransposed) {\\n // dispose of the\n transposed tensor.\n backend.disposeData(transposed.dataId);\n }\\n\\n if (keepDims) {\\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\\n\\n\n return out;\n}\\n\\nexport const maxConfig: KernelConfig = {\\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as { } as KernelFunc\n};\n\\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\n * \\n * Unless required by applicable law or
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agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig:\n KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet\n wasmMaxPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} = args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // TF API supports int32 input. CPU and WebGL backend also support\n // int32 // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out =\n backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
```

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*/\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, [number, number, number]);\n}\n\nexport function mean(\n args:
{ backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs }):\n TensorInfo {\n const { backend, inputs,
attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n
 // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' });\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n
 // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n //
reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n }\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return
out;\n}\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n */
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```

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*/\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction min(args: { backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x }
```

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= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize,\n outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: min as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n *

* See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n
*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See

the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n
*/\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-
paddings\n 'array', // post-paddings\n 'number',\n // mode\n 'number', // outId\n]);\n\n function mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend:
BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const
postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new

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Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
 MirrorPaddingMode[mode], outId);\n return out;\n}\n\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport
{ createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const
multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\n\nimport
{ createUnaryKernelConfig } from './unary_kernel';\n\nexport const negConfig: KernelConfig =
createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`. \n\ninterface Result
{\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs:
number;\n}\n", "/*\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`. \n\nexport
function parseResultStruct(\n backend: BackendWasm, resOffset: number): Result {\n const result = new
Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const pSelectedIndices = result[0];\n const
selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs = result[3];\n // Since the
result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n 'number', // Result*\n [\n
 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', //
iouThreshold\n 'number', // scoreThreshold\n]);\n\n function kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor
 =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:

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NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as  
{ } as KernelFunc,\n);\n", "/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed  
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Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed  
on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {parseResultStruct} from './NonMaxSuppression_util';\nlet
wasmFunc:\n (boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number,
scoreThreshold: number, softNmsSigma: number) =>\n number;\nfunction setup(backend: BackendWasm):
void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', //
iouThreshold\n 'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n}\nfunction
kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId,
scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n const {pSelectedIndices,
selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n // Since we are
not using validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as { } as KernelFunc,\n);\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n*\n\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2020
Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmOneHot
= backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', //
onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\nfunction oneHot(\n args: {inputs:
OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const
{indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return out;\n\n}\n\nexport const oneHotConfig:
KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
{} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.toArrayFromHeap(out);\n outVals.fill(1);\n return
out;\n\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n
kernelFunc: onesLike as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {concat} from './Concat';\n\nimport {expandDims} from
'./ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs:
PackAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length
=== 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const
shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n
shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype ===
t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n
expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n
return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n\n}\n\nexport const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the

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* =====\n*\n*\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null\n/* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n}\n\nfunction pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(xId, xShapeBytes, x.shape.length, CCppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as KernelFunc,\n setupFunc: setup\n};\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n\n* =====\n*\n*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n\n* =====\n\n
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*\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
(input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmpPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n\n export const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing
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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n
'number',\n 'number'\n]);\n\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs:
ProdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmpProd(inputId, reduceSize,\n CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n }\n\n export const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: prod as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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2UsIFZlcnNpb24gMi4wICh0aGUgXCJMaWNlbnNlXCIP01xulCogeW91IG1heSBub3QgdXNIIHRoaXMgZmlsZ  
SBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHRoZSBMaWNlbnNlIxcGww91IG1heSBvYnRhaW4gYSB  
jb3B5IG9mIHRoZSBMaWNlbnNlIGF0XG4gKlxlCogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJ  
Q0VOU0UtMi4wXG4gKlxlCogaVW5sZXXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFnemVIZC  
B0byBpbiB3cmI0aW5nLCBzb2Z0d2FyZVxuIcogZGlzdHJpYnV0ZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZ  
GlzdHJpYnV0ZWQgb24gYW4gXCJBUyBUU1wiEJBU0ITLFxuIcogV0IUSE9VVCBXXVJSQU5USUUVTIE9SIE  
NPTkRjVElPTIMgT0YgQU5ZIEtJTkQsIGVpdGhlcjBleHByZXNzIG9yIGltcGxpZWQuXG4gKiBTZWUgdGhlIE  
xpY2Vuc2UgZm9yIHRoZSBzcGVjaWZpYyBsYW5ndWFnZSBnb3Zlcm5pbmcgcGVybWlze2l2bnMgYW5kXG4  
gKiBsaW1pdGF0aW9ucyB1bmRlciB0aGUgTGJjZW5zZS5cbiAqID09PT09PT09PT09PT09PT09PT09PT09PT  
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0IhtEYXRhVHlwZU1hcCwgZXRpbH0gZnJvbSAnQHRlbnNvcmsZsb3cvdGZqcyljb3JlJztcbXlXZWhw3J0IGZ1bm  
N0aW9uIHJhbmdlSW1wbChcbiAgICBzdGFydDogbnVtYmVyc3RldG9wOiBudW1iZXIsIHN0ZXA6IG51bWJlci  
xcbiAgICBkdHlwZTogJ2Zsb2F0MzInfCdpbnQzMicpOiBEYXRhVHlwZU1hcFsnZmxvYXQzMicgcAnaW50Mz  
InXSB7XG4gIGNvbnN0IHNhbWVtdGFydFN0b3AgPSBzdGFydCA9PT0gc3RvcDtcbiAgY29uc3QgaW5jcmVhc  
2luZ1JhbmdlTmVnYXRpdmVtdGVwid0gc3RhcncGqPCBzdG9wICYmIHN0ZXAgaPCAwO1xulCjBj25zdCBkZ  
WNyZWZfZaW5nUmFuZ2VQb3NpdG12ZVN0ZXAgPSBzdG9wIDwgc3RhcncGqJiYyc3RlcCA+IDE7XG5cbiAga  
WYgKHNhbWVtdGFydFN0b3AgfHwgaW5jcmVhc2luZ1JhbmdlTmVnYXRpdmVtdGVwIHx8XG4gICAgICBk  
ZWNyZWZfZaW5nUmFuZ2VQb3NpdG12ZVN0ZXApIHtcbiAgICByZXR1cm4gdXRpbC5tYWtlWmVyb3NUeXB  
lZEfycmF5KDasIGR0eXB1KTtcbiAgfVxuXG4gIGNvbnN0IG51bUVsZW1lbnRzID0gTWF0aC5hYnMoTWF0aC  
5jZWlsKChzdG9wIC0gc3RhcncqIC8gc3RlcCkqO1xulCjBj25zdCB2YWx1ZXMgPSBldGlsLm1ha2VaZXJvc1R  
5cGVkQXJyYXkobnVtRWxlWVudHMsIGR0eXB1KTtcblxlCjBzZiAoc3RvcCA8IHN0YXJ0ICYmIHN0ZXAgaP  
T09IDEpIHtcbiAgICAvLyBBdXRvIGFkanVzdCB0aGUgc3RlcDdzIHNpZ24gaWYgaXQgaGFzbid0IGJlZW4gc2V  
0XG4gICAgLy8gKqG9yIHdhcyBzZXQgdG8gMSlcbiAgICBzdGVwid0gLTE7XG4gIH1lbnRzID0gTWF0aC5hYnMoTWF0aC  
F0gPSBzdGFydDtcbiAgZm9yIChsZXQgaSA9IDE7IGkgPCB2YWx1ZXMubGVuZ3RoOyBpKypSIHtcbiAgICB2  
YWx1ZXNbaV0gPSB2YWx1ZXNbaSAtdFdiCsgc3RlcDtcbiAgfVxuIcByZXR1cm4gdmdFsdWVzO1xufVxuIl19"

"/\*\*\n  
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for  
the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n
*/\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC.

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governing permissions and\n * limitations under the License.\n *
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```
=====\n
*/\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the

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```

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```
=====\n*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport\n {createUnaryKernelConfig} from './unary_kernel';\nexport const relu6Config: KernelConfig =\n createUnaryKernelConfig(Relu6);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nlet wasmResizeBilinear: (\n xId:\n number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,\n newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\nfunction\n setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n function resizeBilinear(args: {\n backend:\n BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }): TensorInfo {\n const {backend,\n inputs, attrs} = args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters,\n size} = attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] =\n images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =\n backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =\n backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n const out =\n backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmResizeBilinear(\n xId, batch, oldHeight,\n oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n if\n (castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n }\n export const\n resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {identity} from './Identity';\nimport {reshape} from './Reshape';\nlet wasmReverse: (\n xId: number, axes:\n Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>\n void;\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
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'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n]);\n\n\nexport function reverse(\n args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length
=== 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n return reshaped;\n }\n\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as { } as KernelFunc,\n setupFunc:
setup\n};\n\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', //
centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n\n\nexport function
rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs:
RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const
{radians, fillValue, center} = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const
imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue,
fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n\n const fillBytes = new
Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth,
numChannels, radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n\n return out;\n}\n\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as { } as KernelFunc,\n setupFunc: setup\n};\n\n\n/*\n * @license\n * Copyright 2021
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
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*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n

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* =====\n
*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
'./types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //
sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n
'number' // outId\n]);\n\n function scatterNd(\n args:\n {backend: BackendWasm, inputs:
ScatterNdInputs,
attrs: ScatterNdAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} =
inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if
(util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides,
outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,
stridesBytes, outputSize, outId);\n\n return out;\n }\n\n export const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n backendName: 'wasm',\n

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 setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n };}\n", "/*\n * @license\n * Copyright 2020
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number,

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eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number',
// eId\n 'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
const
selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { } as
KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm}
from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}): TensorInfo {\n
const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n
return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from

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'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n\n function softmax(\n args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}):\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} = args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape, logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return out;\n }\n\n export const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n };}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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=====\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {padV2Config} from './PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number, number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n\n const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs: TransposeAttrs = {\n permutedReshapedPaddedPermutation\n }; \n const paddedXT =\n transpose({inputs: transposeInputs, backend, attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs: resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
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express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { slice } from './Slice';\nexport function splitV(\n args: { inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm }) {\n const\n { inputs, attrs, backend } = args;\n const { x } = inputs;\n const { numOrSizeSplits, axis } = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map((s\n => {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({ inputs: { x }, attrs: { begin, size: xSliceSize }, backend });\n begin[$axis] += s;\n return xSlice;\n }));\n}\n\nexport const\n splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as KernelFunc\n };\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on
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an "AS IS" BASIS, \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. \* See the License for the specific language governing permissions and \* limitations under the License. \*

```
=====\n
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n\n function step(\n args: {backend:
BackendWasm, inputs: StepInputs, attrs: StepAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return
out;\n }\n\n export const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: step as {} as KernelFunc\n };
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Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under
the License.\n *
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```
=====\n
*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'/Reshape';\n\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n
'number', // outShapeLength\n 'number', // outId\n]);\n\n export function stridedSlice(args: {\n backend:
BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n }): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
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stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes
 =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new
 Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
 beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n", "/*\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
 {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n 'number', //
dtype\n 'number', // out_id\n]);\n}\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const
{x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let
reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
 reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,
 reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n}

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return out;\n)\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //
x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =
attrs;\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out =
backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CCppType[out.dtype], outId);\n return
out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: tile as {} as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied. \* See the License for the specific language governing permissions and \* limitations under the License. \*

```
=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTopK:
(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean,
 outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',
// x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n
'number', // outIndicesId\n]);\n\nexport const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n
const {k, sorted} = attrs;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n\n return [outValues, outIndices];\n
};\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: topk as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:
number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:
number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n
'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n
'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n
'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape, image.dtype);\n
const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const

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transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n
fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId =
4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n
return out;\n\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: transform as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {slice} from
'./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):
TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;
i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n
for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId,
dtype, shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n
backendName: 'wasm',\n kernelFunc: unpack as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.toArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n\n *\\\n//
We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the

```

```

library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\n\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from
 './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}
from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
{ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
{concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
 './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport
{fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport
{mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport
{negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from

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./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
./kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n"}\n\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n
*\n\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n])));\n\n**\n * True if threads are supported.\n *\n\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try
{\n // Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n"}\n\n\nvar WasmBackendModuleThreadedSimd = (function() {\n

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var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\. /this.program\";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object\";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function\";ENVIRONMENT_IS_NODE=typeof process==="object\"&&typeof
process.versions==="object\"&&typeof
process.versions.node==="string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=non
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\")}arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insep
ect\"]=function(){return\"[Emscripten Module object]\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\"worker_threads\")}catch(e){console.error(\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data==="object\");return data};if(typeof

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scriptArgs!=="undefined"){arguments_=scriptArgs}else if(typeof
arguments!=="undefined"){arguments_=arguments}if(typeof
quit===\function\){quit_=function(status){quit(status)}}if(typeof print!=="undefined"){if(typeof
console===\undefined\){console={};console.log=print;console.warn=console.error=typeof
printErr!=="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !== \undefined\ &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\")!=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs\");if(!nodePath)nodePath=require(\path\");filename=n
odePath[\normalize\](filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{}if(ENVIRONMENT_IS_NODE){if(typeof
performance===\undefined\){global.performance=require(\perf_hooks\).performance}}var
out=Module[\print\]||console.log.bind(console);var err=Module[\printErr\]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\])arguments_=Module[\arguments\];if(Module[\thisProgram\])thisProgram=
Module[\thisProgram\];if(Module[\quit\])quit_=Module[\quit\];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\wasmBinary\])wasmBinary=Module[\wasmBinary\];var
noExitRuntime=Module[\noExitRuntime\]||true;if(typeof WebAssembly!=="object"){abort(\no
native wasm support detected\)}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[_"+ident];assert(func,\Cannot call unknown function \"+ident+", make sure
it is exported\");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\string\:function(str){var ret=0;if(str===null&&str!=="undefined"&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array\:function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string")return UTF8ToString(ret);if(returnType===\boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=="0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var

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numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!==\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAtAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module[\"wasmMemory\"];buffer=Module[\"buffer\"]}else{if(Module[\"wasmMemory\"]){wasmMemory=
Module[\"wasmMemory\"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\"bad
memory\")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function

```

```

preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,`addRunDependency cannot be used in a
pthread
worker`);runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(`Pthread aborting at `+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what=`abort(`+what+`)`. Build with -s
ASSERTIONS=1 for more info.`;var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function
hasPrefix(str,prefix){return String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=`data:application/octet-stream;base64,`;function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=`file://`;function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=`tfjs-backend-wasm-threaded-
simd.wasm`;if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw`both async and sync fetching of the
wasm failed`} }catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:`same-
origin`}).then(function(response){if(!response["ok"]){throw`failed to load wasm binary file at
`+wasmBinaryFile+``})return
response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={`a`:asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency(`wasm-
instantiate`)}))} }if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(`wasm-instantiate`)}function

```

```

receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw"Canceled!"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===function){callback(Module);continue}var func=callback.func;if(typeof
func===number){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADDE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw"Atomics.notify returned an unexpected value
"+ret}Module["_emscripten_futex_wake"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var

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pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runn
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined }functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`"Internal Error! cancelThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`"Internal Error! Null pthread_ptr in
cancelThread!\`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd\`:"cancel\`"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`"Internal Error! cleanupThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`"Internal Error! Null pthread_ptr in
cleanupThread!\`;var
pthread=PThread.threads[pthread_ptr];if(pthread){ GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)} }var
PThread={ unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){ while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){ Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\`:"exit\`"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\`:"cancelDone\`"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)} }PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null },returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n(){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){ GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var

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```

d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+'\', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"]);}else
if(cmd===\'killThread\'){killThread(d["thread"]);}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"]);}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\'print\'){out("Thread \"+d["threadId"]+"": \"+d["text"]);}else
if(cmd===\'printErr\'){err("Thread \"+d["threadId"]+"": \"+d["text"]);}else if(cmd===\'alert\'){alert("Thread
\"+d["threadId"]+"": \"+d["text"]);}else if(cmd===\'exit\'){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"]);}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\'setimmediate\'){worker.postMessage(e.data)}else{err("worker sent an unknown command
\'"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
an error! \"+e.filename+"":\'+e.lineno+"":
\'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
ata}});worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
Message({"cmd":\'load\',\'urlOrBlob\':Module["mainScriptUrlOrBlob"]|_scriptDir,\'wasmMemory\':wasmMe
mory,\'wasmModule\':wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\'tfjs-backend-wasm-threaded-simd.worker.js\');PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function
getNoExitRuntime(){return noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function
invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("Assertion failed: \'+UTF8ToString(condition)+'", at:
\'+[filename?UTF8ToString(filename):\'unknown filename\'],line,func?UTF8ToString(func):\'unknown
function\')}}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]}}else if(typeof
dateNow!==\'undefined\'){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return

```



```

value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
 _emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
 __emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessage
 e({"cmd\":"processQueuedMainThreadWork"})}else
 if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread\":"targetThreadId","cmd\":"processThreadQueue
 e"})}else{var pthread=PThread.pthreads[targetThreadId];var
 worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd\":"processThreadQueue"})}ret
 urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
 args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
 _emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
 _emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
 28;if(!ENVIRONMENT_IS_WEB){var
 ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
 73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
 0;throw\"Atomics.wait returned an unexpected value
 \"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
 tNow=performance.now();var tEnd=tNow+timeout;var
 lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
 w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
 n_thread_futex>>2,0);return-
 73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
 0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
 =val){return-
 6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
 0}}function
 _emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
 _emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
 navigator[\"hardwareConcurrency\"]}function
 _emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
 stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
 b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
 ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
 n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
 readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
 ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
 double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
 ++>>1]:GROWABLE_HEAP_I32()[buf];++buf)return readAsmConstArgsArray}function
 _emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
 rgs.length=numCallArgs;var b=args>>3;for(var
 i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
 ar
 isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
 1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
 _emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
 emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
 buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
 1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
 oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var

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maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var

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length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;_emsripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):"";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)

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{return ext["isVertexArrayOES"](vao);return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs);return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined||JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\\"+j+"\\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function

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_emsripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":_emsripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emsripten_webgl_create_context(a0,a1){return _emsripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err}(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emsripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iowcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iow,iowcnt,pnum);var num=0;for(var i=0;i<iowcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":!?"run",!?"start_routine":threadParams.startRoutine,!?"arg":threadParams.arg,!?"threadInfoStruct":thre

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adParams.pthread_ptr,\'stackBase\':threadParams.stackBase,\'stackSize\':threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
__pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\'undefined\'){err(\'Current
environment does not support SharedArrayBuffer, pthreads are not available!\');return
6}if(!pthread_ptr){err(\'pthread_create called with a null thread pointer!\');return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
__emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\'spawnThread\';postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\'Canceled!\'}function
__emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\'Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\')}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\'pthread_join attempted on a null thread
pointer!\');return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\'PThread
\'"+thread+\' is attempting to join to itself!\');return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()===thread){err(\'Main
thread \'"+thread+\' is attempting to join to itself!\');return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\'pthread_join attempted on thread
\'"+thread+\' , which does not point to a valid thread, or does not exist anymore!\');return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\'Attempted to join thread
\'"+thread+\' , which was already detached!\');return
ERRNO_CODES.EINVAL}if(block){__emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus===1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\'cmd\':\'cleanupThread\',\'thread\':thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)__emscripten_main_thre
ad_process_queued_calls();__emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function

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pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,__emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
__emscripten_asm_const_int,\"j\":__emscripten_conditional_set_current_thread_status,\"d\":__emscripten_futex_wait,\"
c\":__emscripten_futex_wake,\"f\":__emscripten_get_now,\"p\":__emscripten_memcpy_big,\"A\":__emscripten_num_l
ogical_cores,\"u\":__emscripten_receive_on_main_thread_js,\"q\":__emscripten_resize_heap,\"v\":__emscripten_set_ca
nvas_element_size,\"i\":__emscripten_set_current_thread_status,\"s\":__emscripten_set_thread_name,\"w\":__emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"])=Module[\"asm\"][\"B\"].apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"])=Module[\"asm\"][\"C\"].apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"])=Module[\"asm\"][\"D\"].apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"])=Module[\"asm\"][\"E\"].apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"])=M
odule[\"asm\"][\"F\"].apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"])=Module[\"
asm\"][\"G\"].apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"])=Module[\"asm\"][\"H\"].apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"])=Module[\"asm\"][\"J\"].apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"])=Module[\"asm\"][\"K\"].apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"])=Module[\"asm\"][\"L\"].apply(null,ar
guments)};var

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_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["M"]]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["N"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["O"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["P"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["R"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["T"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["V"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var

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_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(null,arguments)};var

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_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"Ga"]).apply(null,arguments);var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(null,arguments);var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(null,arguments);var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).apply(null,arguments);var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(null,arguments);var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(null,arguments);var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"Ma"]).apply(null,arguments);var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).apply(null,arguments);var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"Oa"]).apply(null,arguments);var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(null,arguments);var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(null,arguments);var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra"]).apply(null,arguments);var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).apply(null,arguments);var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments);var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments);var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments);var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(null,arguments);var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ya"]).apply(null,arguments);var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,arguments);var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"a"]).apply(null,arguments);var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Sa"]).apply(null,arguments);var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,arguments);var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,arguments);var

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_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){return(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscript

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en_tls_init\"]=Module[\asm\"][\wb\").apply(null,arguments)};var
__emscripten_thread_init=Module[__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Module[__emscripten_thread_init\"]=Module[\asm\"][\xb\").apply(null,arguments)};var
stackSave=Module[\stackSave"]=function(){return(stackSave=Module[\stackSave\"]=Module[\asm\"][\yb\").a
pply(null,arguments)};var
stackRestore=Module[\stackRestore"]=function(){return(stackRestore=Module[\stackRestore\"]=Module[\asm\
][\zb\").apply(null,arguments)};var
stackAlloc=Module[\stackAlloc"]=function(){return(stackAlloc=Module[\stackAlloc\"]=Module[\asm\"][\Ab\
]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module[__emscripten_stack_set_limits"]=function(){return(__emscripten_stack_set_
limits=Module[__emscripten_stack_set_limits\"]=Module[\asm\"][\Bb\").apply(null,arguments)};var
__memalign=Module[__memalign"]=function(){return(__memalign=Module[__memalign\"]=Module[\asm\"][\Cb
\").apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module[__emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module[__emscripten_main_thread_futex"]=12148;Module[\cwrap"]=cwrap
;Module[\PThread"]=PThread;Module[\PThread"]=PThread;Module[\wasmmemory"]=wasmmemory;Module
[\ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name=\ExitStatus\";this.message=\Program terminated with
exit(\"+status+\");this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({\cmd\":\loaded\});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[\calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\onRuntimeInitialized\"])Module[\onRuntimeInitialized\"]();postRun(
)}if(Module[\setStatus\"]){Module[\setStatus\"](\Running..");setTimeout(function(){setTimeout(function(){Mo
dule[\setStatus\"](\),1);doRun(),1)}else{doRun()})}Module[\run\"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({\cmd\":\exitProcess\","\returnCode\":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module[\onExit\"])Module[\onExit\"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[\preInit\"]){if(typeof
Module[\preInit\"]=\function\"){Module[\preInit\"]=Module[\preInit\"];while(Module[\preInit\"].length>0){
Module[\preInit\"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n)}();\nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports[\WasmBackendModuleThreadedSimd\"]=
WasmBackendModuleThreadedSimd;\n","\nvar WasmBackendModule = (function() {\n var _scriptDir = typeof
document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof
__filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n
WasmBackendModule = WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\undefined"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module[\ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in

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Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\object";ENVIRONMENT_IS_WORKER=typeof
importScripts===\function";ENVIRONMENT_IS_NODE=typeof process===\object"&&typeof
process.versions===\object"&&typeof
process.versions.node===\string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\";function
locateFile(path){if(Module[\locateFile"]){return Module[\locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\path\").
dirname(scriptDirectory)+\^"}else{scriptDirectory=__dirname+\^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs");if(!nodePath)nodePath=require(\path");filename=n
odePath[\normalize\](filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\argv\].length>1){thisProgram=process[\argv\"][1].replace(/\\/g,\^");arguments_=process[\arg
v\"].slice(2);process[\on\](\uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\on\](\unhandledRejection",abort);quit_=function(status){process[\exit\](status)};Module[\inspect\"]=function(){return\[Emscripten Module object]\"}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\function"){return new
Uint8Array(readbuffer(f))}data=read(f,\binary");assert(typeof data===\object");return data};if(typeof
scriptArgs!=\undefined){arguments_=scriptArgs}else if(typeof
arguments!=\undefined){arguments_=arguments}if(typeof
quit===\function"){quit_=function(status){quit(status)}if(typeof print!=\undefined){if(typeof
console===\undefined)console={};console.log=print;console.warn=console.error=typeof
printErr!=\undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\")!==(0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\^")+1)}else{scriptDirectory=\"}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType=\arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType=\arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module[\print\"]||console.log.bind(console);var err=Module[\printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\"])arguments_=Module[\arguments\"];if(Module[\thisProgram\"])thisProgram=
Module[\thisProgram\"];if(Module[\quit\"])quit_=Module[\quit\"];var
wasmBinary;if(Module[\wasmBinary\"])wasmBinary=Module[\wasmBinary\"];var
noExitRuntime=Module[\noExitRuntime\"]||true;if(typeof WebAssembly!=\object"){abort(\no native wasm

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support detected\")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,\Cannot call unknown function "+ident+", make sure it is exported");return
func}function
ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!=null&&str!=undefined&&str!=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string\)return UTF8ToString(ret);if(returnType===\boolean\)return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number\});var
numericRet=returnType!==\string\;if(numericRet&&numericArgs&&!opts){return
getCFunc(ident)}return function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var
UTF8Decoder=typeof TextDecoder!==\undefined"?new TextDecoder(\utf8\"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str=""";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\HEAP16\"]=HEAP16=new Int16Array(buf);Module[\HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\INITIAL_MEMORY\"]||16777216;var wasmTable;var __ATPRERUN__=[];var

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__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\"+what+\"). Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-
wasm.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"}return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\")}addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-

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origin\").then(function(response){ var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))} else{ return
instantiateArrayBuffer(receiveInstantiatedSource)} if(Module[\"instantiateWasm\"]){ try{ var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports } catch(e){ err(\"Module.instantiateWasm
callback failed with error: \"+e);return false } }instantiateAsync().catch(readyPromiseReject);return { } }function
callRuntimeCallbacks(callbacks){ while(callbacks.length>0){ var callback=callbacks.shift();if(typeof
callback===\"function\") { callback(Module);continue } var func=callback.func;if(typeof
func===\"number\") { if(callback.arg===undefined){ wasmTable.get(func)() } else{ wasmTable.get(func)(callback.arg)
} } else{ func(callback.arg===undefined?null:callback.arg) } } }function _abort(){ abort() }function
_emscipten_memcpy_big(dest,src,num){ HEAPU8.copyWithin(dest,src,src+num) }function
_emscipten_get_heap_size(){ return HEAPU8.length }function
emscipten_realloc_buffer(size){ try{ wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1 } catch(e){ } }function _emscipten_resize_heap(requestedSize){ var oldSize=_emscipten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){ return false } for(var
cutDown=1;cutDown<=4;cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscipten_realloc_buffer(newSize);if(replacement){ return true } } return false } var
SYSCALLS={ mappings: { }, buffers: [null,[],[]], printChar: function(stream,curr) { var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){ (stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0 } else{ buffer.push(curr) } }, varargs: undefined, get: function(ptr) { SYSCALLS.varargs+=4; var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret }, getStr: function(ptr) { var ret=UTF8ToString(ptr);return
ret }, get64: function(low,high) { return low } };function _fd_close(fd) { return 0 }function
_fd_seek(fd,offset_low,offset_high,whence,newOffset) { }function _fd_write(fd,iov,iocnt,pnum) { var num=0;for(var
i=0;i<iocnt;i++){ var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){ SYSCALLS.printChar(fd,HEAPU8[ptr+j]) } num+=len } HEAP32[pnum>>2]=num;return
0 }function _pthread_create() { return 6 }function _pthread_join() { return 28 }function
setErrNo(value) { HEAP32[___errno_location()>>2]=value;return value }function
_sysconf(name) { switch(name) { case 30: return 16384; case 85: var maxHeapSize=2147483648;return
maxHeapSize/16384; case 132: case 133: case 12: case 137: case 138: case 15: case 235: case 16: case 17: case 18: case
19: case 20: case 149: case 13: case 10: case 236: case 153: case 9: case 21: case 22: case 159: case 154: case 14: case
77: case 78: case 139: case 82: case 68: case 67: case 164: case 11: case 29: case 47: case 48: case 95: case 52: case 51: case
46: return 200809; case 27: case 246: case 127: case 128: case 23: case 24: case 160: case 161: case 181: case 182: case
242: case 183: case 184: case 243: case 244: case 245: case 165: case 178: case 179: case 49: case 50: case 168: case
169: case 175: case 170: case 171: case 172: case 97: case 76: case 32: case 173: case 35: case 80: case 81: case 79: return-
1; case 176: case 177: case
7: case 155: case 8: case 157: case 125: case 126: case 92: case 93: case 129: case 130: case 131: case 94: case 91: return
1; case 74: case 60: case 69: case 70: case 4: return 1024; case 31: case 42: case 72: return 32; case 87: case 26: case
33: return 2147483647; case 34: case 1: return 47839; case 38: case 36: return 99; case 43: case 37: return 2048; case
0: return 2097152; case 3: return 65536; case 28: return 32768; case 44: return 32767; case 75: return 16384; case
39: return 1e3; case 89: return 700; case 71: return 256; case 40: return 255; case 2: return 100; case 180: return 64; case
25: return 20; case 5: return 16; case 6: return 6; case 73: return 4; case 84: { if(typeof navigator===\"object\") return
navigator[\"hardwareConcurrency\"]||1; return 1 } } setErrNo(28); return -1 } var
asmLibraryArg={ \"a\": _abort, \"d\": _emscipten_memcpy_big, \"e\": _emscipten_resize_heap, \"f\": _fd_close, \"c\": _f
d_seek, \"b\": _fd_write, \"h\": _pthread_create, \"g\": _pthread_join, \"i\": _sysconf }; var asm=createWasm(); var

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__wasm_call_ctors=Module["__wasm_call_ctors"]=function(){return(__wasm_call_ctors=Module["__wasm
_call_ctors"]=Module["asm"]["k"]).apply(null,arguments)};var
_init=Module["_init"]=function(){return(_init=Module["asm"]["l"]).apply(null,arguments)};
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Mod
ule["_init_with_threads_count"]=Module["asm"]["m"]).apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads
_count"]=Module["asm"]["n"]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=M
odule["asm"]["o"]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"
]["p"]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"]["q"]).apply(n
ull,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"]["s"]).apply(null,arguments
)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"]["t"]).apply(null,argument
s)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"]["u"]).apply(null,ar
guments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"]["v"]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"]["w"]).apply(null,argumen
ts)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]["x"]).app
ly(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]["y"]).a
pply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm"]["z"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["A"]).apply(null,argument
s)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["
asm"]["B"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["C"]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm"]["D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["E"]).apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["F"]).apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=
Module["asm"]["G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).a
pply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=M
odule["asm"]["I"]).apply(null,arguments)};var

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_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=function(){return(_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["V"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["W"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["_"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["ea"]]).apply(null,arguments)};var

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_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var

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_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea"]).ap
ply(null,arguments);var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(null,argumen
ts);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga"]).apply(nu
ll,arguments);var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][_"Ha"]).apply(null,arguments);var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia"]).apply(null,argume
nts);var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][_"Ja"]).apply(null,arguments);var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(null,argument
s);var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(null,argum
ents);var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(null,argumen
ts);var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(null,argu
ments);var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(null,argumen
ts);var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa"]).apply(null,ar
guments);var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"
Qa"]).apply(null,arguments);var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"R
a"]).apply(null,arguments);var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][_"Sa"]).apply(null,arguments);var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"Ta"]).apply(nu
ll,arguments);var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"Ua"]).apply(null,argument
s);var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][_"Va"]).apply(null,arguments);var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][_"Wa"]).
apply(null,arguments);var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][_Xa"]).apply(null,arguments);var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][_"Ya"
]).apply(null,arguments);Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name=_"ExitStatus";this.message=_"Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function

```

```
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("\Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"]("\")},1);doRun()},1)}else{doRun()}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]!="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n);\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under
```

the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the  
License.\n \* You may obtain a copy of the License at\n \* \n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \* \n \*\n Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed  
on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*

```
=====\n
*\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport
wasmFactoryThreadedSimd from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport
{wasmWorkerContents} from './wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory
from './wasm-out/tfjs-backend-wasm.js';\nninterface TensorData {\n id: number;\n memoryOffset: number;\n
shape: number[];\n dtype: DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded
bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-
primitive.\n\nexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private
dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:
backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n
numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n
return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n
dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n
const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes,
shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n
const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id,
size, memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n
(values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,
numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId):
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *
```

```

util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the
memory if the dataId
 has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force
Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if
(this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force
&& data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return
refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n
const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n
incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n
 }\n }\n\n floatPrecision(): 32 {\n return 32;\n
}\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n
 this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size =
util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId,
shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray
{\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const
size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,
memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n
return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype
${dtype}`);\n }\n }\n\n\nfunction createInstantiateWasmFunc(path: string) {\n // this will be replace by rollout
plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n
return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n
if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n
response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n
callback(output.instance, output.module);\n });\n });\n });\n });\n return {};\n }\n\n\n/**\n * Returns the
path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param threadsSupported
whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM
binaries.\n */\nfunction getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full
path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n\n let path:
WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-
backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n
 }\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n
 }\n\n return wasmModuleFolder + path;\n }\n\n\n/**\n * Initializes the wasm module and creates the js <--> wasm
bridge.\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning
Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\nexport async
function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await
Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
 env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>

```

```

{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function
overrides the Emscripten module locateFile utility.\n * @param path The relative path to the file that needs to be
loaded.\n * @param prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile =
(path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const
blob = new Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n\n return prefix
+ path;\n };\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n
 factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n
simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix :
));\n }\n\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten
already called console.warn so no need to double log.\n return;\n }\n\n if (initAborted) {\n //
Emscripten calls `onAbort` twice, resulting in double error\n // messages.\n return;\n }\n\n initAborted
= true;\n const rejectMsg =\n 'Make sure the server can serve the `.wasm` file relative to the ' +\n
'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n
 reject({message: rejectMsg});\n };\n\n let wasm:
Promise<BackendWasmModule>;\n // If `wasmPath` has been defined we must initialize
the vanilla module.\n if (threadsSupported && simdSupported && wasmPath == null) {\n
factoryConfig.mainScriptUrlOrBlob = new Blob(\n [\n var WasmBackendModuleThreadedSimd = ` +\n
wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'};\n],\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor: module.cwrap(\n
'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n 'number', //
memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n dispose:
module.cwrap('dispose', voidReturnType, []),\n };\n\n resolve({wasm: module});\n });\n\n function typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n
switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case 'int32':\n return new
Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new
Error(`Unknown dtype ${dtype}`);\n }\n}\n\n const wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-
backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const
;\n\n type WasmBinaryName = typeof wasmBinaryNames[number];\n\n let wasmPath: string = null;\n let
wasmPathPrefix: string = null;\n let wasmFileMap: {[key in WasmBinaryName]?: string} = {};\n let initAborted =
false;\n let customFetch = false;\n\n /**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the
`.wasm` file which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n */\n /**\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*/\n export function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' ' will be removed in a future release.);\n }
if

```

```

(initAborted) {\n throw new Error(\n
 "The WASM backend was already initialized. Make sure you call '+\n `setWasmPath()` before you call
 `tf.setBackend()` or `tf.ready()`");\n }\n wasmPath = path;\n customFetch = usePlatformFetch;\n}\n\n/**\n *
 Configures the locations of the WASM binaries.\n *\n * ``js\n * setWasmPaths({\n * 'tfjs-backend-wasm.wasm':
 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n * 'tfjs-backend-wasm-threaded-
 simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n * ``\n *\n * @param
 prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory where the WASM
 binaries are located.\n * - Note that this prefix will be used to load each binary (vanilla,\n * - SIMD-enabled,
 threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n * - full paths
 specifying the locations of those binaries. This is useful if\n * - your WASM binaries are not all located in the same
 directory,
 or if your\n * - WASM binaries have been renamed.\n * @param usePlatformFetch optional boolean to use
 platform fetch to download\n * - the wasm file, default to false.\n *\n * @doc {heading: 'Environment', namespace:
 'wasm'}\n */\nexport function setWasmPaths(\n prefixOrFileMap: string|{[key in WasmBinaryName]?: string},\n
 usePlatformFetch = false): void {\n if (initAborted) {\n throw new Error(\n "The WASM backend was already
 initialized. Make sure you call '+\n `setWasmPaths()` before you call `tf.setBackend()` or '+\n
 `tf.ready()`");\n }\n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else
 {\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name =>
 wasmFileMap[name] == null);\n if (missingPaths.length > 0) {\n throw new Error(\n `There were no
 entries found for the following binaries: ` +\n `${missingPaths.join(',')}. Please either
 call setWasmPaths with a ` +\n `map providing a path for each binary, or with a string indicating ` +\n
 `the directory where all the binaries can be found.`);\n }\n }\n }\n customFetch = usePlatformFetch;\n}\n\n/**
 Used in unit tests. *\nexport function resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n
 wasmFileMap = {};\n customFetch = false;\n initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
 actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
 threadpool (default to the number of logical CPU cores).\n *\n * This must be called before calling
 `tf.setBackend('wasm')`.\n *\nexport function setThreadsCount(numThreads: number) {\n threadsCount =
 numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n *\n * It is set after the
 backend is initialized.\n *\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n
 throw new Error(`WASM
 backend not initialized.`);\n }\n return actualThreadsCount;\n}\n\n",\nexport const wasmWorkerContents = 'var
 Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(\n
 `");console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join(\n
 `");postMessage({cmd:"alert",text:text,threadId:Module["__pthread_self"]()})}var
 err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
 instance=new
 WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
 eturn instance.exports};function
 moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wasmModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
 e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var
 objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
 WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
 if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else
 if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-
 e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
 top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"](

```



```

);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self"])(0,1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["PThread"].threadExit(result)}catch(ex){if(ex==="Canceled!"){Module["PThread"].threadCancel()}else
if(ex!="unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}}else{Module["PThread"].threadExit(ex.status)}}else
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}}else
if(e.data.target==="setimmediate"){}}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()}else{err("worker.js received unknown command
"+e.data.cmd);err(e.data)}}catch(ex){err("worker.js onmessage() captured an uncaught exception:
"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process==="object"&&typeof
process.versions==="object"&&typeof process.versions.node==="string"){self={location:{href:__filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require("worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on("message",function(data){onmessage({data:data})});var
nodeFS=require("fs");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,"utf8");};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance==="undefined"){performance={now:function(){return Date.now()}}};"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from 'tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n\n const {wasm} = await init();\n\n return new
BackendWasm(wasm);\n\n}, WASM_PRIORITY);\n\n"/** @license See the LICENSE file. *\n\n// This code is
auto-generated, do not modify this file!\n\nconst version = '3.11.0';\n\nexport
{version};\n\n],"names":["CppType","FusableActivation","wasmFusedMatMul","fusedMatMulConfig","kernelNa
me","_FusedMatMul","backendName","setupFunc","backend","wasm","cwrap","kernelFunc","args","inputs","attrs
","a","b","bias","preluActivationWeights","dtype","Error","transposeA","transposeB","activation","leakyreluAlpha",
"aId","dataIdMap","get","dataId","id","bId","biasId","biasData","shape","length","preluActivationWeightsId","fuse
dActivation","leftDim","rightDim","batchDim","out","makeOutput","outId","aShapeBytes","Uint8Array","Int32Arr
ay","buffer","bShapeBytes","createUnaryKernelConfig","outType","wasmFunc","x","xId","util","sizeFromShape","
absConfig","Abs","createBinaryKernelConfig","supportsFullBroadcast","outputType","newShape","backend_util","
assertAndGetBroadcastShape","aBroadcastDims","getBroadcastDims","bBroadcastDims","loopsOverAllOfA","eve
ry","v","i","loopsOverAllOfB","addConfig","Add","addNConfig","AddN","inputIds","map","inputIdsBytes","identi
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in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.min.js.map

No license file was found, but licenses were detected in source scan.

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```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n*\nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nfunction onesLike(args: { inputs: OnesLikeInputs, backend: BackendWasm }) {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as KernelFunc,\n};
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OnesLike.js.map

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```

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```

*\n\nimport { KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmStep: (xId: number,
alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', //
dtype\n 'number', // out_id\n]);\n\nfunction step(\n args: { backend: BackendWasm, inputs: StepInputs, attrs:
StepAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { alpha } = attrs;\n const { x } =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const out = backend.makeOutput(x.shape,
x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype],
outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n\n}}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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No license file was found, but licenses were detected in source scan.

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```

```

=====\n
*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
waswFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n 'number' // batch\n]);\n\nfunction softmax(\n args: { backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const channels = logits.shape[dim];\n

```

```
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as { } as KernelFunc\n};\n"]}
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Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Softmax.js.map
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No license file was found, but licenses were detected in source scan.

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```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.js.map
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CAA8C;AAC9C,OAAO,CAAC,kCAAkC,CAAC,CAAC","sourcesContent":["/\*\*\n

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```
=====\n\n*\n\n// Import core for side effects (e.g. flag registration)\nimport '@tensorflow/tfjs-core';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/public/chained_ops/register_all_chained_ops';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/register_all_gradients';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {setTestEnvs, setupTestFilters, TestFilter} from\n '@tensorflow/tfjs-core/dist/jasmine_util';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport ({name: 'test-wasm', backendName: 'wasm', isDataSync:\n true});\n\n/**\n * Tests that have these substrings in their name will be included unless one\n * of the strings in\n * excludes appears in the name.\n */\nconst TEST_FILTERS: TestFilter[] = [\n {\n startsWith: 'tensor',\n excludes: [\n 'complex', // Complex\n numbers not supported yet\n 'derivative', // Gradients not yet supported.\n // Downcasting broken, see:\n https://github.com/tensorflow/tfjs/issues/2590\n 'Tensor2D float32 -> bool', 'Tensor2D int32 -> bool'\n]\n },\n {\n include: 'softmax',\n {\n include: 'pow',\n excludes: [\n 'gradient', // zerosLike not defined yet.\n 'broadcasting same rank Tensors different shape', // Broadcasting along\n // inner\n dims not\n // supported yet.\n]\n },\n {\n include: 'add',\n excludes: [\n 'gradient', // Gradient is missing.\n 'upcasts when dtypes dont match', // Uses the 'complex'\n dtype.\n 'complex', // Complex numbers not supported yet\n]\n },\n {\n include: 'depthToSpace',\n {\n include: 'avgPool',\n excludes: [\n 'gradient', // Not yet implemented.\n 'avgPool3d', // Not yet implemented.\n]\n },\n {\n include: 'relu',\n excludes: [\n 'derivative',\n // Not yet implemented.\n 'gradient', // Not yet implemented.\n 'valueAndGradients', // Not yet\n implemented.\n 'broadcasted bias', // Not yet implemented.\n 'fused A x B with 2d bias' // Fused matMul\n with 2D bias not yet\n // supported.\n]\n },\n {\n include: 'maxPool',\n excludes: [\n 'maxPoolBackprop', // Not yet implemented.\n 'maxPool3d', // Not yet implemented.\n 'maxPool3dBackprop', // Not yet implemented.\n 'ignores NaNs', // Actual != expected.\n 'maxPoolWithArgmax' // Not yet implemented.\n]\n },\n {\n include: 'cropAndResize',\n {\n include: 'resizeBilinear',\n excludes: [\n 'gradients', // Not yet implemented.\n]\n },\n {\n include: 'matmul',\n excludes: [\n 'valueAndGradients',\n
```

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// Gradients not defined yet\n 'gradient', // Gradients not defined yet\n 'zero in its shape',
// Zero in shapes aren't supported yet\n 'matmul followed by mul', // mul not supported yet\n 'upcasts',
// Upcasting not supported yet.\n 'fused A x B with 2d bias', // Fused matMul with 2D bias not yet\n
// supported.\n]\n },\n {\n include: 'depthwiseConv2D ',\n excludes: [\n 'broadcasted bias', //
Broadcasted bias not yet supported.\n 'gradient', // Gradients not defined yet.\n 'NCHW', // xnn
pack does not support channels first.\n]\n },\n {\n include: 'conv2d ',\n excludes: [\n 'broadcasted bias', //
Broadcasted bias not yet supported.\n 'gradient', // Gradients not defined yet.\n 'backProp input
x=[2,3,3,1] f=[2,2,1,1] s=1 p=0', // Gradients not\n
// defined.\n 'NCHW', // xnn pack does not support channels first.\n // Issue:
https://github.com/tensorflow/tfjs/issues/3104.\n // Actual != expected.\n 'relu bias stride 2 x=[1,8,8,16]
f=[3,3,16,1] s=[2,2] d=8 p=same',\n 'prelu bias stride 2 x=[1,8,8,16] f=[3,3,16,1] s=[2,2] d=8 p=same',\n]\n
},\n {\n include: 'conv2dTranspose ',\n excludes: ['gradient']},\n {\n include: 'prelu ',\n excludes: [\n 'gradient', //
Gradient is missing.\n 'derivative' // Missing gradient.\n]\n },\n {\n include: 'cast ',\n excludes: [\n
'complex', // Complex numbers not yet implemented.\n 'shallow slice an input that was cast' // Slice is not
implemented.\n]\n },\n {\n include: 'gather',\n excludes: [\n 'gradient' // Not yet implemented.\n]\n },\n
{\n include: 'sigmoid ',\n excludes: [\n 'sigmoidCrossEntropy', // Not yet implemented.\n 'gradient'
// Not
yet implemented.\n]\n },\n {\n include: 'scatterND ',\n {\n include: 'abs ',\n excludes: [\n 'gradient', // Not
yet implemented.\n 'complex' // Complex numbers not supported yet.\n]\n },\n {\n include: 'sub ',\n
excludes: [\n 'complex', // Complex numbers not yet implemented.\n 'gradient', // Not yet implemented.\n
'upcasts', // Upcasting not supported yet.\n]\n },\n {\n include: 'mul ',\n excludes: [\n 'complex', //
Complex numbers not yet supported.\n 'gradient', // Gradient not defined yet.\n]\n },\n {\n include: 'div ',\n
excludes: [\n 'gradient', // Gradient not defined yet.\n 'upcasts', // Cast not supported yet.\n 'divNoNan' //
divNoNan not yet implemented.\n]\n },\n {\n include: 'batchNorm',\n excludes: [\n 'gradient' // Gradient
is missing.\n]\n },\n {\n include: 'slice ',\n {\n include: 'stridedSlice ',\n {\n include: 'rotate ',\n {\n include:
'rotateWithOffset'},\n
{\n include: 'flipLeftRight ',\n {\n include: 'square ',\n {\n include: 'squaredDifference'},\n {\n startsWith: 'min ',\n
excludes: [\n '2D, axis=0', // Permuted axes requires transpose, which is not yet\n // implemented.\n
'index corresponds to start of a non-initial window', // argMin not yet\n // implemented.,\n 'gradient' // Gradients not yet implemented\n]\n },\n {\n startsWith: 'max ',\n excludes:
[\n 'gradient' // Gradients not yet implemented\n]\n },\n {\n include: 'concat',\n excludes: [\n 'complex',
// Complex numbers not supported yet\n 'gradient' // Split is not yet implemented\n]\n },\n {\n include:
'transpose'},\n {\n include: 'oneHot'},\n {\n include: 'split'},\n {\n include: 'pad ',\n excludes: ['complex', 'zerosLike']},\n {\n
include: 'clip',\n excludes: [\n 'gradient',\n 'propagates NaNs' // clip
delegates to XNNPACK which does not make\n // guarantees about behavior of nans.\n]\n },\n
{\n include: 'addN'},\n {\n include: 'nonMaxSuppression'},\n {\n include: 'argmax',\n excludes: ['gradient']},\n {\n include: 'exp
'},\n {\n include: 'elu',\n excludes: [\n 'derivative', // Not yet implemented.\n 'gradient', // Not yet
implemented.\n 'selu' // Not yet implemented.\n]\n },\n {\n include: 'unstack'},\n {\n include:
'minimum',\n excludes: [\n 'gradient', // Not yet implemented.\n 'broadcasts 2x1
Tensor2D and 2x2 Tensor2D' // Broadcasting along inner\n // dims not supported
yet.\n]\n },\n {\n include: 'maximum',\n excludes: [\n 'gradient', // Not yet
implemented.\n 'broadcasts 2x1 Tensor2D and 2x2 Tensor2D' // Broadcasting along inner\n
// dims not supported yet.\n]\n },\n {\n include: 'log ',\n },\n {\n startsWith: 'equal ',\n excludes:
[\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported
yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as
above.\n 'string'\n]\n },\n {\n include: 'greater ',\n excludes: [\n 'broadcasting Tensor2D shapes', //
Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes',

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// Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include:
'greaterEqual',\n excludes: [\n 'gradient', // Not yet implemented.\n 'broadcasting Tensor2D
shapes', // Broadcasting along outer dims not\n // supported yet.\n
'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n
'string'\n]\n },\n {\n include: 'less ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along
outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n
'broadcasting Tensor3D float32', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n
'string'\n]\n },\n {\n include: 'lessEqual',\n excludes: [\n 'gradient', // Not yet implemented.\n
'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported
yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor3D float32', // Same as
above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include:
'notEqual',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n
// supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D
shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'mean ',\n excludes: [\n 'axis=0', // Reduction
not supported along inner dimensions.\n]\n },\n {\n startsWith: 'reverse',\n },\n {\n startsWith: 'sum ',\n },\n
{\n startsWith: 'cumsum',\n },\n {\n startsWith: 'logicalAnd ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting
along outer dimensions\n // not yet supported.\n 'broadcasting Tensor3D shapes', // Same
as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n]\n },\n {\n startsWith: 'tile ',\n excludes:
[\n 'gradient', // Gradient not yet implemented.\n 'string tensor' // String tensors not yet implemented.\n
]\n },\n {\n startsWith: 'sin ',\n },\n {\n startsWith: 'cos ',\n excludes: [\n 'gradient', // Gradient not yet
implemented.\n]\n },\n {\n startsWith: 'cosh',\n excludes: [\n 'gradient' // Gradient not yet implemented.\n
]\n },\n {\n startsWith: 'tan',\n excludes: ['gradient'] // Gradient not yet implemented.\n\n },\n {\n
startsWith: 'tanh ',\n excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n startsWith: 'rsqrt ',\n
excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n startsWith: 'sqrt ',\n excludes: ['gradient'] //
Gradient not yet implemented.\n },\n {\n startsWith: 'where ',\n excludes: [\n '1D condition with higher rank
a and b', // Fill not yet implemented.\n 'gradient' // Gradient not yet implemented.\n]\n },\n
{\n startsWith: 'zerosLike',\n // Complex numbers not supported yet.\n excludes: ['complex'],\n
},\n {\n startsWith: 'onesLike',\n // Complex numbers not supported yet.\n excludes: ['complex'],\n },\n
{\n include: 'prod',\n },\n {\n include: 'floor',\n },\n {\n include: 'topk',\n },\n {\n include: 'expandDims',\n },\n
{\n include: 'stack',\n },\n {\n include: 'round',\n // Pool is not supported yet.\n excludes: ['pool'],\n },\n
{\n include: 'step kernel',\n },\n {\n include: 'ceil',\n },\n {\n include: 'mirrorPad',\n },\n {\n startsWith: 'all',\n
excludes: [\n 'ignores NaNs' // Doesn't yet ignore NaN\n]\n },\n {\n startsWith: 'any',\n excludes: [\n
'ignores NaNs' // Doesn't yet ignore NaN\n]\n },\n {\n include: 'image.transform',\n },\n {\n include: 'batchToSpaceND',\n },\n
{\n include: 'spaceToBatchND',\n },\n\n\nconst
customInclude = (testName: string) => {\n // Include all regular describe() tests.\n if (testName.indexOf('test-
wasm') < 0) {\n return true;\n }\n\n // Include all of the wasm specific tests.\n if (testName.startsWith('wasm'))
{\n return true;\n }\n\n return
false;\n};\n\nsetupTestFilters(TEST_FILTERS, customInclude);\n\n// Import and run all the tests from core.\n//
tslint:disable-next-line:no-imports-from-dist\n// tslint:disable-next-line:no-require-
imports\nrequire('@tensorflow/tfjs-core/dist/tests');\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup_test.js.map
No license file was found, but licenses were detected in source scan.

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```

=====
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm}) {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const\nsplitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as {} as KernelFunc\n};\n}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SplitV.js.map

No license file was found, but licenses were detected in source scan.

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2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a  
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=====\n \*/\n//

We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the  
library. A modular build would replace\n// the contents of this file and import only the kernels that are  
needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}  
from './kernels/\_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from  
 './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport  
 {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}  
 from './kernels/AvgPool';\nimport  
 {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from  
 './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from  
 './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {concatConfig} from  
 './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from  
 './kernels/Conv2DBackpropInput';\nimport {cosConfig} from './kernels/Cos';\nimport {coshConfig} from  
 './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from  
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 './kernels/Min';\nimport {minimumConfig} from './kernels/Minimum';\nimport {mirrorPadConfig} from

```

./kernels/MirrorPad';\nimport { multiplyConfig } from './kernels/Multiply';\nimport { negConfig } from
./kernels/Neg';\nimport { nonMaxSuppressionV3Config } from './kernels/NonMaxSuppressionV3';\nimport
{ nonMaxSuppressionV4Config } from './kernels/NonMaxSuppressionV4';\nimport { nonMaxSuppressionV5Config }
from './kernels/NonMaxSuppressionV5';\nimport { notEqualConfig } from './kernels/NotEqual';\nimport
{ oneHotConfig } from './kernels/OneHot';\nimport { onesLikeConfig } from './kernels/OnesLike';\nimport
{ packConfig } from './kernels/Pack';\nimport { padV2Config } from './kernels/PadV2';\nimport { powConfig } from
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{ reluConfig } from './kernels/Relu';\nimport { relu6Config } from './kernels/Relu6';\nimport { reshapeConfig } from
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from './kernels/Round';\nimport { rsqrtConfig } from './kernels/Rsqrt';\nimport { scatterNdConfig } from
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{ softmaxConfig } from './kernels/Softmax';\nimport { spaceToBatchNDConfig } from
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./kernels/Sqrt';\nimport { squareConfig } from './kernels/Square';\nimport { squaredDifferenceConfig } from
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{ tanhConfig } from './kernels/Tanh';\nimport { tileConfig } from './kernels/Tile';\nimport { topKConfig } from
./kernels/TopK';\nimport { transformConfig } from './kernels/Transform';\nimport { transposeConfig } from
./kernels/Transpose';\nimport { unpackConfig } from './kernels/Unpack';\nimport { zerosLikeConfig } from
./kernels/ZerosLike';\n\n// List all kernel configs here\nconst kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig\n];\n\nfor (const
kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/register_all_kernels.js.map

```

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```
{ "version":3,"file":"AvgPool.js","sourceRoot":"","sources":["../../src/kernels/AvgPool.ts"],"names":[],"mappings":"
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AAK,CAAC,OAAO,EAAE,IAAI,CAAC,UAAU,EAAE;QACzD,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QA
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CR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,OAAO,CACZ,IAAw
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,GAAG,MAAM,CAAC,CAAA,CAAC;IAC/B,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,
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AE,QAAQ,EACzE,KAAK,CAAC,CAAC;IACX,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MA
AM,aAAa,GAaB;IACzC,UAAU,EAAE,OAAO;IACnB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IA
ChB,UAAU,EAAE,OAA2B;CACxC,CAAC", "sourcesContent":["/*\n

```

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```
=====\n
*\n\nimport {AvgPool, AvgPoolAttrs,
AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmAvgPool: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number,
padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number,
channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool =
backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n
```

```

 args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape,
filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const channels =
convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend only
supports average pooling with dilation = [1, 1], ` +\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as {} as KernelFunc\n};\n"}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.js.map

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\* =====  
\*/

/\*\*

\* @deprecated Use `setWasmPaths`  
instead.  
\* Sets the path to the `wasm` file which will be fetched when the wasm  
\* backend is initialized. See  
\* <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>  
\* for more details.  
\* @param path wasm file path or url

```
* @param usePlatformFetch optional boolean to use platform fetch to download
* the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
*/
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.js
```

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```
{"version":3,"file":"tf-backend-wasm.node.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/Maximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts","../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_util.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSuppressionV5.ts","../src/kernels/NotEqual.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pack.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/Range.ts","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Softmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts","../src/kernels/SquaredDifference.ts","../src/kernels/Step.ts","../src/kernels/StridedSlice.ts","../src/kernels/Sub.ts","../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../src/kernels/TopK.ts","../src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../src/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-simd.worker.js","../wasm-out/tfjs-backend-wasm.js","../src/backend_wasm.ts","../src/version.ts","../src/base.ts"],"sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
```

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```
=====\n*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport\nenum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu = 6\n}\n\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR\n * CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\n * permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusableActivation } from\n './types';\n\nlet wasmFusedMatMul:\n (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number',\n // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' //\n out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:\n BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b, bias,\n preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n `_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB,\n activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =\n backend.dataIdMap.get(b.dataId).id;\n let biasId = 0;\n if (bias !== null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new\n Error(\n `_FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw\n new Error(\n `_${activation}_ activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :\n b.shape[2];\n const batchDim = a.shape[0];\n const out = backend.makeOutput([batchDim, leftDim, rightDim],\n a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
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```
=====\n*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nexport function\ncreateUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:\n number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): \n TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)\n === 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return\n {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an\n * "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions\n and\n * limitations under the License.\n */\n\n=====\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n '../unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nexport\nfunction createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:\n DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*\n void */,\n [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): \n \n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType =\n dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,\n b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new\n Int32Array(b.shape).buffer);\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
```

```

a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32')
 {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n
return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet `+\n
`supported for ${a.dtype} ${kernelName}.`);\n }\n\n return {kernelName, backendName: 'wasm', setupFunc,
kernelFunc};\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs,
backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-
sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n", "/*\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nexport function

```

```

identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {
 const {inputs: {x}, backend} = args;
 const out = backend.makeOutput(x.shape, x.dtype);
 const inVals = backend.typedArrayFromHeap(x);
 const outVals = backend.typedArrayFromHeap(out);
 outVals.set(inVals);
 return out;
}

export const identityConfig: KernelConfig = {
 kernelName: Identity,
 backendName: 'wasm',
 kernelFunc: identity as {} as KernelFunc,
};

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 * limitations under the License.
 */
=====
import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {identity} from './Identity';
import {CppType} from './types';

let wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;

function setup(backend: BackendWasm) {
 wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [
 'number', // xId
 'array', // x.shape
 'number', // x.shape.length
 'number', // dtype
 'number', // outId
 'array', // perm
 'number', // perm.length
]);

 export function transpose({inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}): TensorInfo {
 const {inputs, backend, attrs} = args;
 // Reduce any dimensions with size one. Lower-rank transpose kernel performs
 // better due to simpler memory access pattern.
 const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);

 let permIsNoOp = true;
 for (let i = 0; i < perm.length; i++) {
 if (perm[i] !== i) {
 permIsNoOp = false;
 }
 }

 const outShape = computeOutShape(inputs.x.shape, attrs.perm);
 const x = {dataId: inputs.x.dataId, shape: reducedShape, dtype: inputs.x.dtype};

 if (permIsNoOp) {
 const cloned = identity({inputs, backend});
 cloned.shape = outShape;
 return cloned;
 }

 const out = backend.makeOutput(outShape, x.dtype);
 const xId = backend.dataIdMap.get(x.dataId).id;
 const outId = backend.dataIdMap.get(out.dataId).id;
 const permBytes = new Uint8Array(new Int32Array(perm).buffer);
 const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

 wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, perm.length);

 return out;
 }

 function computeOutShape(inShape: number[], perm: number[]): number[] {
 const outShape = new Array(inShape.length);
 for (let i = 0; i < outShape.length; i++) {
 outShape[i] = inShape[perm[i]];
 }
 return outShape;
 }

 function removeOneSizeDims(shape: number[], perm: number[]): [number[], number[]] {
 const newShape: number[] = [];
 const newPerm: number[] = [];
 for (let i = 0; i < shape.length; i++) {
 if (shape[i] !== 1) {
 newShape.push(shape[i]);
 }
 if (shape[perm[i]] !== 1) {
 newPerm.push(perm[i]);
 }
 }
 for (let i = 0; i < newPerm.length; i++) {
 let minValIdx = -1;
 for (let j = 0; j < newPerm.length; j++) {
 if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {
 minValIdx = j;
 }
 }
 newPerm[minValIdx] = i;
 }
 return [newShape, newPerm];
 }

 export const transposeConfig: KernelConfig = {
 kernelName: Transpose,
 backendName: 'wasm',
 kernelFunc: transpose as {} as KernelFunc,
 setupFunc: setup,
 };

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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
}

```

```

=====
*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose
if necessary.\n *\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n *
@param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n x: TensorInfo,\n axis: number|number[],\n backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const
originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if
(permutedAxes != null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i <
newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n\n axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n
 }\n }\n\n return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet
wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:
{backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} =
args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const
inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const
[outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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=====

```

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```
=====\n*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n { permuteAxesAndTranspose } from './kernel_utils';\nlet wasmAny: (xId: number, reduceSize: number, outId:\n number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,\n null /*void*/, [number, number, number]);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,\n attrs: AnyAttrs }):\n TensorInfo {\n const { backend, inputs,\n attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,\n inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',\n axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,\n originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: any as {} as\n KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */\n=====\n
```

```
\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-\n core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from\n './kernel_utils';\nimport { CppDType } from './types';\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:\n number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null / void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:\n { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId\n = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n permuteAxesAndTranspose(x,\n axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const\n innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if\n (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n}
```

```

}\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n
 kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup;\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
 const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
 const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
 const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
 throw new Error(\n `wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1], ` +\n
 `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as {} as KernelFunc;\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '
@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =

```

```

util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount
for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
kernelFunc: reshape as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport
{BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const
{transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n
aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions
must either be the ` +\n `same or at least one input batch dimension must be 1. Got input ` +\n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and ` +\n ` ${innerShapeB} of Tensors with shapes
${a.shape} and ` +\n ` ${b.shape} and transposeA=${transposeA} ` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation is
designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n
const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const

```













GlsLmZyb21VaW50OFRvU3RyaW5nQXJyYXkodmFscyBhecyBvaW50OEFycmF5W10pIDpcbiAgICAgIHZhbH  
MgYXMgVHlwZWRCbnJheTtcblxuc216ZTsgKytKSB7XG4gICAgY29uc3Qgb3V0QnVmID0gYnVmZmVYKHNpemUsIGR0eXB1KTtcbiAgZm9yIChsZXQgaSA  
REYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVYKHNpemUsIGR0eXB1KTtcbiAgZm9yIChsZXQgaSA  
9IDA7IGkgPCBvdXRcdWYuc216ZTsgKytKSB7XG4gICAgY29uc3Qgb3V0TG9jID0g3V0QnVmLmluZGV4V  
G9Mb2MoasK7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRm2MubWfWkChpZHG6IG51bWJlciwgaigkPT4ga  
WR4ICsgYmVnaW5bal0pO1xuICAgIG91dEJ1Zi5zZXQoaW5CdWYuZ2V0KC4uLmluTG9jKjSwgLi4ub3V0TG9j  
KTtcbiAgfVxuXG4gIGlmIChkdHlwZSA9PT0gJ3N0cmIuZycpIHtcbiAgICBzYXR1cm4gYmFja2VuZGF91dGlsLm  
Zyb21TdHJpbmdBcnJheVRvVWludDgob3V0QnVmLnZhbHVlcYBhecyBzdHJpbmdBcXSk7XG4gIH1cbiAgcmV0d  
XJuIG91dEJ1Zi52YWx1ZXMgYXMgVHlwZWRCbnJheTtcblxuc216ZTsgKytKSB7XG4gICAgY29uc3Qge2lucHV0cywYmFja2VuZC  
ICAgIGFyZ3M6IHtpbnB1dHM6IFNsaWNISW5wdXRzLCBiYWNrZW5kOiBNYXR0QmFja2VuZENQVSwgYX  
R0cnM6IFNsaWNlQXR0cnN9KTtcbiAgICBUZ2V5b3JjbmZvIHtcbiAgY29uc3Qge2lucHV0cywYmFja2VuZC  
wgYXR0cnN9ID0gYXJncztcblxuc216ZTsgKytKSB7XG4gICAgY29uc3Qge2lucHV0cywYmFja2VuZC  
0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbiAgICBzYXR1cm4gYmFja2VuZC  
c2l6ZV0gPSBzbGljZV91dGlsLnBhcniU2xpY2VQYXJhbXMoeCwgYmVnaW5sIHNPemUpO1xuICBzYXR1cm4gYmFja2VuZC  
1dGlsLmFzc2VydFBhcmFtc1ZhbGkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYWN  
NrZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRm2MubWfWkChpZHG6IG51bWJlciwgaigkPT4ga  
wodmFscywGJlZ2luLCAkc2l6ZSweC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNrZW5kLm1ha2  
VUZ2V5b3JjbmZvKCRzaXplLCB4LmR0eXB1LCBvdXRWYWxzKTtcbiAgICBzYXR1cm4gYmFja2VuZC  
IQ29uZmlnOiBLZXJlZmV0d25maWcgPSB7XG4gIGtcm5lbE5hbWU6IFNsaWNlFxcuICBiYWNrZW5kTmFtZ  
TogJ2NwdScsXG4gIGtcm5lbEZ1bmM6IHNSaWNlIGFzIHt9IGFzIEtcm5lbEZ1bmNcbn07XG4iXX0=","/\*\*\n

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\* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License  
for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {sliceImplCPU} from
 '../kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinous = slice_util.isSliceContinous(x.shape, begin_,
size_);\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const
xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype ===
'string') {\n outData.stringBytes =\n (xVals as Uint8Array[])\n .slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n\n outVals.set(\n (xVals as TypedArray)\n .subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n }\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return
out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as
[number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals
as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number,
number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n begin_ as [number, number, number, number],\n size_ as [number, number, number,
number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride:
```

```

number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i =
beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset +
size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction
slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:
backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <
endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:
backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number,
number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK =
begin[2];\n
const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL =
begin[3];\n\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k <
endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n
outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc:
slice as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed
under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n const
permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n
attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig
= {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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```
=====\n*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from 'tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}): \n TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const castConfig: \n KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as { } as \n KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig: \n KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as { } as \n KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```

*\n\nimport
 {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {concatImplCPU} from
 './kernel_utils/shared';\n\nimport {identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nexport function
concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t
=> t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype === 'string') {\n //
Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional
tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis
to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these
two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to
have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors
along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n
const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape
=\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n
const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.toArrayFromHeap(input));\n
const outVals = backend.toArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b *
sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset =
b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals,
outOffset);\n outOffset += innerDim;\n }\n }\n return out;\n}\n\nexport const concatConfig: KernelConfig =
{\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n};\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====\n
*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,

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inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,
 null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n ` ${convInfo.dataFormat}`. Please
 use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under
the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number,
xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
waswConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n
'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n
'number', //

```

```

outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', //
xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number',
// yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n
'number', // yChannelStride\n 'number', // outId\n]);\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n
const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n *
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from

```

./unary\_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number, extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number' // out id\n]);\n\n function cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { method, extrapolationValue, cropSize } = attrs;\n const { image, boxes, boxInd } = inputs;\n\n const numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData = backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData = cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' }});\n imagesData = backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const out = backend.makeOutput(outShape, 'float32');\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth, InterpolationMethod[method as {}] as keyof typeof InterpolationMethod,\n extrapolationValue, outId);\n\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n }\n\n export const cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n }; \n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nimport { transpose } from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n]\n
```



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out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n
 setupFunc: setup,\n kernelFunc: depthToSpace as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from
'./backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number, inputHeight: number,
inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n
padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number,
dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n }) {\n const { inputs, attrs, backend } = args;\n\n const { x, filter } = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
{ strides, dilations, pad, dimRoundingMode } = attrs;\n\n const $dilations = dilations === null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth
= convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n
const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
DepthwiseConv2dNative does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use
'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n filterWidth,\n padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n\n return out;\n }\n\n export const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
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```
=====\n*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,\nKernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank}\n]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
```

the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { Fill, FillAttrs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function fill(args: { attrs: FillAttrs, backend: BackendWasm }) {\n const { attrs: { shape, value, dtype }, backend } = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: { inputs: FlipLeftRightInputs, backend: BackendWasm }): TensorInfo {\n const { inputs, backend } = args;\n const { image } = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { FloorDiv, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =
```

createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n *\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {FusableActivation} from './types';\n\nlet wasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n]\n
```





```

void;

function setup(backend: BackendWasm) {
 const wasmFusedDepthwiseConv2d =
 backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [
 'number', // xId
 'number', // batchSize
 'number', // inputHeight
 'number', // inputWidth
 'number', // filterId
 'number', // filterHeight
 'number', // filterWidth
 'number', // biasId
 'number', // padTop
 'number', // padRight
 'number', // padBottom
 'number', // padLeft
 'number', // isSamePad
 'number', // dilationHeight
 'number', // dilationWidth
 'number', // strideHeight
 'number', // strideWidth
 'number', // inputChannels
 'number', // outputChannels
 'number', // activation
 'number', // preluActivationWeightsId
 'number', // leakyreluAlpha
 'number', // outId
]);

 function fusedDepthwiseConv2d(args: {
 inputs: FusedDepthwiseConv2DInputs,
 backend: BackendWasm,
 attrs: FusedDepthwiseConv2DAttrs
 }) {
 const {inputs, attrs, backend} = args;
 const {x, filter, bias, preluActivationWeights} = inputs;
 const {
 strides,
 pad,
 dilations,
 dataFormat,
 dimRoundingMode,
 activation,
 leakyreluAlpha
 } = attrs;

 const convInfo = backend_util.computeConv2DInfo(
 (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
 pad, dimRoundingMode, true /* depthwise */);

 const fusedActivation =
 FusableActivation[activation as keyof typeof FusableActivation];

 if (fusedActivation == null) {
 throw new Error(
 `${activation} activation not yet supported for FusedDepthwiseConv2D` +
 `in the wasm backend.`);
 }

 const xId = backend.dataIdMap.get(x.dataId).id;
 const filterId = backend.dataIdMap.get(filter.dataId).id;
 const outputChannels = convInfo.outChannels;

 let biasId = 0;
 if (bias != null) {
 const biasData = backend.dataIdMap.get(bias.dataId);
 if (biasData.shape.length !== 1) {
 throw new Error(
 `FusedDepthwiseConv2D only supports rank-1 bias but got` +
 `rank ${biasData.shape.length}`);
 }
 if (biasData.shape[0] !== outputChannels) {
 throw new Error(
 `FusedDepthwiseConv2D bias shape (${biasData.shape}) does not` +
 `match the number of output channels (${outputChannels})`);
 }
 biasId = biasData.id;
 }

 const filterHeight = convInfo.filterHeight;
 const filterWidth = convInfo.filterWidth;
 const padTop = convInfo.padInfo.top;
 const padRight = convInfo.padInfo.right;
 const padBottom = convInfo.padInfo.bottom;
 const padLeft = convInfo.padInfo.left;
 const dilationHeight = convInfo.dilationHeight;
 const dilationWidth = convInfo.dilationWidth;
 const strideHeight = convInfo.strideHeight;
 const strideWidth = convInfo.strideWidth;
 const inputChannels = convInfo.inChannels;
 const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
 const batchSize = convInfo.batchSize;
 const inHeight = convInfo.inHeight;
 const inWidth = convInfo.inWidth;

 if (dataFormat !== 'NHWC') {
 throw new Error(
 `wasm backend FusedDepthwiseConv2D does not support dataFormat:` +
 `${dataFormat}`. Please use 'NHWC'.`);
 }

 const out = backend.makeOutput(convInfo.outShape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 const preluActivationWeightsId = preluActivationWeights == null ? 0 :
 backend.dataIdMap.get(preluActivationWeights.dataId).id;

 wasmFusedDepthwiseConv2d(
 xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,
 biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,
 dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,
 fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);

 return out;
 }

 export const fusedDepthwiseConv2DConfig: KernelConfig = {
 kernelName: FusedDepthwiseConv2D,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc
 };
}

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
import {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-

```

```

core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n
 sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n
'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}): \n TensorInfo {\n const {backend, inputs} = args;\n const
{params, indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,
params.dtype);\n if (numSlices === 0) {\n return out;\n }\n\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n
 const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig:
KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
gatherNd\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n
'array', // outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm,
inputs: GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const
{x, indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n
const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId)
as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const
index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2:
the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n
shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n
});\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x:
indices},\n attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const
flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n
shapeInfo.sliceSize\n];\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if
(util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length - 1;\n const
xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =

```

```

backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n
 const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n", "/**\n
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 under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
\n
*\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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 * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
\n
*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }
from '/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from
 '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from
'/types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,
 null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n]);\n\n \nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs,
attrs: LeakyReluAttrs,
 backend: BackendWasm\n }):\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,

```

```
outId);\n })\n return out;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law\n * or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n\n*/\nimport { KernelConfig, LogicalAnd } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\n createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License\n * is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
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the License.\n \*

```
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =
transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n
backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed)
{\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n
// reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n }\n\n return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing
permissions and\n * limitations under the License.\n *
```

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=====\n
*\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing
permissions
and\n * limitations under the License.\n *
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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
```

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backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number',
// inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n // TF API
supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it
because it uses xnpack which only\n // supports float32.\n /\n // Add the following assert only for the WASM
backend instead of at core op\n // level.\n /\n // TODO: add support for int32 input.\n util.assert(\n x.dtype
=== 'float32',\n () =>\n `Error in MaxPool: only float32 input
is supported. Got ${x.dtype}.`);\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm
backend does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n
const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n\n"/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean, null /* void */, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,

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input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n
cast({backend, inputs: {x: input}, attrs: {dtype:
'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig: KernelConfig = {\n
kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min,
null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n
]);\n}\n\nfunction min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): \n TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n}\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n
 backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n
* You may obtain a copy of the License at\n *\n *
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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n
 * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n
=====
*\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
 xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
 Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad =
 backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
 x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', //
 mode\n 'number', // outId\n]);\n}\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend:
 BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
 const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new
 Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const
 postPaddingsFlat = paddings.map(padTuple
 => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n
 const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
 xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig:
 KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as
 KernelFunc,\n setupFunc: setup\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
 * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS"\n
 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
 License for the specific language governing permissions and\n * limitations under the License.\n
=====
*\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
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 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
 License for the specific language governing permissions and\n * limitations under the License.\n
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=====
*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`\n *\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize,\n pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from
'./NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize:
number,\n iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', //
Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n
'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold,\n scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the
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=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number',\n // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function nonMaxSuppressionV4(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n }): TensorInfo[]
{\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,\n validOutputsTensor];\n }\n\n export const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {\n as KernelFunc,\n };,\n },"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //\n scoreThreshold\n 'number', // softNmsSigma\n]);\n\n function\n kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n
```

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parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from
the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config:
KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: kernelFunc as { } as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport
{KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2020
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport
{KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue:
number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n
'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n}\n\nfunction oneHot(\n args:
{inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n
const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth,
onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n kernelName:
OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as { } as KernelFunc,\n};\n", "/**\n
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nfunction onesLike(args: {inputs:
OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out =

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backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n }\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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/\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null\n / void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =

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new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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=====\n
*/\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
weightsId = backend.dataIdMap.get(alpha.dataId).id;\n let inputId = xId;\n const input = x;\n let
castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x},
attrs: {dtype: 'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n const out =
backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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=====\n
*/\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport

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{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n}\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =\n backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape]\n =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n */\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const range =\n (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n const {backend, attrs} = args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n const\n out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n */\n\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.

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```
=====\n\n *\\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from\n './unary_kernel';\\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n *\\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\\n\\nimport\n {createUnaryKernelConfig} from './unary_kernel';\\nexport const relu6Config: KernelConfig =\n createUnaryKernelConfig(Relu6);\\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

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=====\n\n *\\n\\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\\n\\nimport\n {BackendWasm} from '../backend_wasm';\\n\\nimport {cast} from './Cast';\\n\\nlet wasmResizeBilinear: (\\n xId:\n number, batch: number, oldHeight: number, oldWidth: number,\\n numChannels: number, newHeight: number,\n newWidth: number,\\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\\n\\nfunction\n setup(backend: BackendWasm): void {\\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n /*void*/, [\\n 'number', // xId\\n 'number', // batch\\n 'number', // oldHeight\\n 'number', // oldWidth\\n\n 'number', // numChannels\\n 'number', // newHeight\\n 'number', // newWidth\\n 'number', // alignCorners\\n\n 'number', // halfPixelCenters\\n 'number' // outId\\n]);\\n}\\n\\nfunction resizeBilinear(args: {\\n backend:\n BackendWasm,\\n inputs: ResizeBilinearInputs,\\n attrs: ResizeBilinearAttrs\\n}): TensorInfo {\\n const {backend,\n inputs, attrs} = args;\\n const {images} = inputs;\\n const {alignCorners, halfPixelCenters, size}\n = attrs;\\n const [newHeight, newWidth] = size;\\n const [batch, oldHeight, oldWidth, numChannels] =\n images.shape;\\n const outShape = [batch, newHeight, newWidth, numChannels];\\n \\n let xData =\n backend.dataIdMap.get(images.dataId);\\n let castedData;\\n if (xData.dtype !== 'float32') {\\n castedData =\\n\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\\n xData =\n backend.dataIdMap.get(castedData.dataId);\\n }\\n const xId = xData.id;\\n \\n const out =\n backend.makeOutput(outShape, 'float32');\\n if (util.sizeFromShape(images.shape) === 0) {\\n return out;\\n }\\n\n const outId = backend.dataIdMap.get(out.dataId).id;\\n \\n wasmResizeBilinear(\\n xId, batch, oldHeight,\n oldWidth, numChannels, newHeight, newWidth,\\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\\n \\n if\n (castedData != null) {\\n backend.disposeData(castedData.dataId);\\n }\\n \\n return out;\\n }\\n}\\n\\nexport const\n resizeBilinearConfig: KernelConfig = {\\n kernelName: ResizeBilinear,\\n
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backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport\n { identity } from './Identity';\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes:\n Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //\n out_shape_length\n 'number' // out_id\n]);\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs,\n backend: BackendWasm, attrs: ReverseAttrs}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} = attrs;\n const axes = util.parseAxisParam(dims, x.shape);\n if (x.shape.length\n === 0) {\n return identity({inputs: {x}, backend});\n }\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n outId);\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:\n setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n limitations under the License.\n *
```

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=====\n*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\n TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport\n { BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:\n number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //\n batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', //\n fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n}\n\nexport function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =\n backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch,\n imageHeight, imageWidth, numChannels] = image.shape;\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight, imageWidth);\n const fillIsBlack = fillValue === 0;\n const\n fullOpacityValue = 255;\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
```



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wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId:\n number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect\n = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: {inputs: SelectInputs, backend:\n BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n const conditionId =\n backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =\n backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const cRank = condition.shape.length;\n const tRank =\n t.shape.length;\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1:\n util.sizeFromShape(t.shape.slice(1));\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n }\n\n export\n const selectConfig:\n KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {} as KernelFunc,\n setupFunc: setup\n };\n\n ",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *\n *=====\n *\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm}\n from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',\n 'number']);\n\n function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}): \n TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n // Short-circuit\n zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n wasmFunc(xId, outId);\n return out;\n }\n\n export\n const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n };\n\n ",/**\n * @license\n * Copyright\n * 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except\n * in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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=====
*\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n",/**\n * @license\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n 'number' // batch\n]);\n\nfunction softmax(\n args: {backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs}):\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n",/**\n * @license\n * Copyright 2021 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {padV2Config} from
'./PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n}) {\n const {inputs, backend,
attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod =
util.sizeFromShape(blockShape);\n\n const completePaddings: Array<number, number> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<number, number>));\n\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const
reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n

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const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n", "/*\n * @license\n *
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=====\n
*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs,
attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(
=> {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====\n
*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n *
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

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=====
* \nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core'; \nimport {createBinaryKernelConfig} from './binary_kernel'; \nconst supportsFullBroadcast = true; \nexport const squaredDifferenceConfig: KernelConfig = \n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast); \n", /*
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=====
* \n \nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core'; \nimport {BackendWasm} from './backend_wasm'; \nimport {CppType} from './types'; \nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) => \n void; \nfunction setup(backend: BackendWasm): void { \n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id \n 'number', // alpha \n 'number', // dtype \n 'number', // out_id \n]); \n function step(\n args: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs}): \n TensorInfo { \n const {backend, inputs, attrs} = args; \n const {alpha} = attrs; \n const {x} = inputs; \n const xId = \n backend.dataIdMap.get(x.dataId).id; \n const out = backend.makeOutput(x.shape, x.dtype); \n const outId = \n backend.dataIdMap.get(out.dataId).id; \n wasmStep(xId, alpha, CppDType[x.dtype], outId); \n return \n out; \n } \n export const stepConfig: KernelConfig = { \n kernelName: Step, \n backendName: 'wasm', \n setupFunc: \n setup, \n kernelFunc: step as { } as KernelFunc \n }; \n", /*
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OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific language
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License. \n *
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=====
* \n \nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, \n util} from '@tensorflow/tfjs-core'; \nimport {BackendWasm} from './backend_wasm'; \nimport {reshape} from './Reshape'; \nimport {slice} from './Slice'; \nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array, \n xRank: number, \n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, \n outShapeBytes: \n Uint8Array, outStridesBytes: Uint8Array, \n outShapeLength: number, outId: number) => void; \nfunction \n setup(backend: BackendWasm): void { \n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId \n 'array', // xStrides \n 'number', // xRank \n 'array', // beginBytes \n 'array', // endBytes \n 'array', // stridesBytes \n 'array', // outShapeBytes \n 'array', // outStridesBytes \n 'number', \n // outShapeLength \n 'number', // outId \n]); \n export function stridedSlice(args: { \n backend: \n BackendWasm, \n inputs: StridedSliceInputs, \n attrs: StridedSliceAttrs \n }): TensorInfo { \n const {backend, inputs, \n attrs} = args; \n const {x} = inputs; \n const { \n begin, \n end, \n strides, \n beginMask, \n endMask, \n ellipsisMask, \n newAxisMask, \n shrinkAxisMask \n } = attrs; \n const { \n finalShapeSparse, \n
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finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n
} =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n
newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n
backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n
new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n"/**\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n 'number', // dtype\n
'number', // out_id\n]);\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const

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{x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,
reduceShape]
= \n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law
or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n
=====\n
*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (\n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //

```



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x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n
 });\n}\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return\n out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\n http://www.apache.org/licenses/LICENSE-2.0\n * \n *\n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n */\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK:\n (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:\n boolean, outValuesId:\n number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK =\n backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //\n x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n}\n\nexport const topk:\n (\n args: {inputs: TopKInputs, backend: BackendWasm,\n attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes\n = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =\n backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length,\n CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n};\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: topk as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\n http://www.apache.org/licenses/LICENSE-2.0\n * \n *\n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS\n OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions\n and\n * limitations under the License.\n *\n =====\n\n */\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform: (\n imageId:\n number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:\n number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)

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*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm}
from './backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n
const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as {} as
KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n *\n//
We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\n\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\n\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\n\nimport {absConfig} from './kernels/Abs';\n\nimport {addConfig} from
 './kernels/Add';\n\nimport {addNConfig} from './kernels/AddN';\n\nimport {allConfig} from './kernels/All';\n\nimport
{anyConfig} from './kernels/Any';\n\nimport {argMaxConfig} from './kernels/ArgMax';\n\nimport {avgPoolConfig}
from './kernels/AvgPool';\n\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\n\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\n\nimport {castConfig} from './kernels/Cast';\n\nimport
{ceilConfig} from './kernels/Ceil';\n\nimport {clipByValueConfig} from './kernels/ClipByValue';\n\nimport
{concatConfig} from './kernels/Concat';\n\nimport {conv2DConfig} from './kernels/Conv2D';\n\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\n\nimport {cosConfig} from
 './kernels/Cos';\n\nimport {coshConfig} from './kernels/Cosh';\n\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\n\nimport {cumsumConfig} from './kernels/Cumsum';\n\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\n\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\n\nimport {eluConfig} from './kernels/Elu';\n\nimport {equalConfig} from
 './kernels/Equal';\n\nimport {expConfig} from './kernels/Exp';\n\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\n\nimport {fillConfig} from './kernels/Fill';\n\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\n\nimport {floorConfig} from './kernels/Floor';\n\nimport {floorDivConfig} from
 './kernels/FloorDiv';\n\nimport
{fusedBatchNormConfig} from './kernels/FusedBatchNorm';\n\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\n\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\n\nimport {gatherNdConfig} from './kernels/GatherNd';\n\nimport
{gatherV2Config} from './kernels/GatherV2';\n\nimport {greaterConfig} from './kernels/Greater';\n\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\n\nimport {identityConfig} from './kernels/Identity';\n\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\n\nimport {lessConfig} from './kernels/Less';\n\nimport
{lessEqualConfig} from './kernels/LessEqual';\n\nimport {logConfig} from './kernels/Log';\n\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\n\nimport {maxConfig} from './kernels/Max';\n\nimport
{maximumConfig} from './kernels/Maximum';\n\nimport {maxPoolConfig} from './kernels/MaxPool';\n\nimport
{meanConfig} from './kernels/Mean';\n\nimport {minConfig} from './kernels/Min';\n\nimport {minimumConfig} from
 './kernels/Minimum';\n\nimport
{mirrorPadConfig} from './kernels/MirrorPad';\n\nimport {multiplyConfig} from './kernels/Multiply';\n\nimport
{negConfig} from './kernels/Neg';\n\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\n\nimport {nonMaxSuppressionV4Config} from

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./kernels/NonMaxSuppressionV4';\nimport { nonMaxSuppressionV5Config } from
./kernels/NonMaxSuppressionV5';\nimport { notEqualConfig } from './kernels/NotEqual';\nimport { oneHotConfig }
from './kernels/OneHot';\nimport { onesLikeConfig } from './kernels/OnesLike';\nimport { packConfig } from
./kernels/Pack';\nimport { padV2Config } from './kernels/PadV2';\nimport { powConfig } from
./kernels/Pow';\nimport { preluConfig } from './kernels/Prelu';\nimport { prodConfig } from './kernels/Prod';\nimport
{ rangeConfig } from './kernels/Range';\nimport { realDivConfig } from './kernels/RealDiv';\nimport { reluConfig }
from './kernels/Relu';\nimport { relu6Config } from './kernels/Relu6';\nimport { reshapeConfig } from
./kernels/Reshape';\nimport { resizeBilinearConfig }
from './kernels/ResizeBilinear';\nimport { reverseConfig } from './kernels/Reverse';\nimport
{ rotateWithOffsetConfig } from './kernels/RotateWithOffset';\nimport { roundConfig } from
./kernels/Round';\nimport { rsqrtConfig } from './kernels/Rsqrt';\nimport { scatterNdConfig } from
./kernels/ScatterNd';\nimport { selectConfig } from './kernels/Select';\nimport { sigmoidConfig } from
./kernels/Sigmoid';\nimport { sinConfig } from './kernels/Sin';\nimport { sliceConfig } from './kernels/Slice';\nimport
{ softmaxConfig } from './kernels/Softmax';\nimport { spaceToBatchNDConfig } from
./kernels/SpaceToBatchND';\nimport { splitVConfig } from './kernels/SplitV';\nimport { sqrtConfig } from
./kernels/Sqrt';\nimport { squareConfig } from './kernels/Square';\nimport { squaredDifferenceConfig } from
./kernels/SquaredDifference';\nimport { stepConfig } from './kernels/Step';\nimport { stridedSliceConfig } from
./kernels/StridedSlice';\nimport { subConfig } from './kernels/Sub';\nimport { sumConfig } from
./kernels/Sum';\nimport
{ tanConfig } from './kernels/Tan';\nimport { tanhConfig } from './kernels/Tanh';\nimport { tileConfig } from
./kernels/Tile';\nimport { topKConfig } from './kernels/TopK';\nimport { transformConfig } from
./kernels/Transform';\nimport { transposeConfig } from './kernels/Transpose';\nimport { unpackConfig } from
./kernels/Unpack';\nimport { zerosLikeConfig } from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

```

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=====
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n\n**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n
// Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n };\n\n",\n\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(function(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
})return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
})return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!=="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=("./this.program");var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"]}var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var

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nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
"worker_threads" module is not supported in this node.js build - perhaps a newer version is needed?);throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data };if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print} }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=="undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret} }else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance} }var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)} }var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var

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wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function
getCFunc(ident){var func=Module["__"+ident];assert(func,"Cannot call unknown function "+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAtAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new

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Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf) }var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMem
emory=Module["wasmMemory"];buffer=Module["buffer"]}else {if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else {wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try {if(file===wasmBinaryFile&&wasmBinary){return new

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Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\`both async and sync fetching of the
wasm failed\`} }catch(err){abort(err)} }function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\`function\`&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\`same-
origin\`}).then(function(response){if(!response[\`ok\`]){throw\`failed to load wasm binary file at
\`+wasmBinaryFile+\`\" }return
response[\`arrayBuffer\`]()).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject})) } }return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\`a\`:asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\`asm\`]=exports;wasmTable=Module[\`asm\`][\`T\`];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\`wasm-
instantiate\`))})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\`wasm-instantiate\`)}function
receiveInstantiatedSource(output){receiveInstance(output[\`instance\`],output[\`module\`])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}.then(receiver,function(reason){err(\`failed to asynchronously prepare
wasm: \`+reason);abort(reason)}))}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\`function\`&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\`function\`){return fetch(wasmBinaryFile,{credentials:\`same-
origin\`}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\`wasm streaming compile failed: \`+reason);err(\`falling
back to ArrayBuffer instantiation\`);return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\`instantiateWasm\`]){try{var
exports=Module[\`instantiateWasm\`](info,receiver);return exports }catch(e){err(\`Module.instantiateWasm
callback failed with error: \`+e);return false } }instantiateAsync().catch(rejectPromise);return { } }var
ASM_CONSTS={10520:function(){throw\`Canceled!\`},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\`function\`){callback(Module);continue}var func=callback.func;if(typeof
func===\`number\`){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}} }var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENODIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E

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PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\\\": \"cancel\\\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);_emsripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emsripten_register_main_browser_thread_id(tb);.initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);_emsripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({\"cmd\\\": \"exit\\\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({\"cmd\\\": \"cancelDone\\\"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var

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worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){ var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){ var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n(){delete
PThread pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){ GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{ func()}finally{ GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){ worker.onmessage=function(e){ var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){ var
thread=PThread pthreads[d.targetThread];if(thread){ thread.worker.postMessage(e.data,d["transferList"]);}else{ con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+\"', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){ spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){ cleanupThread(d[\"thread\"])}else
if(cmd===\"killThread\"){ killThread(d[\"thread\"])}else
if(cmd===\"cancelThread\"){ cancelThread(d[\"thread\"])}else
if(cmd===\"loaded\"){ worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{ worker.runPthread();delete
worker.runPthread}}else if(cmd===\"print\"){ out(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else
if(cmd===\"printErr\"){ err(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"alert\"){ alert(\"Thread
\"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"exit\"){ var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\"exitProcess\"){ try{ exit(d[\"returnCode\"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){ worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\'"+cmd)\'}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\": \"+e.lineno+\":
\'+e.message)};if(ENVIRONMENT_IS_NODE){ worker.on(\"message\",function(data){ worker.onmessage({ data:d
ata})});worker.on(\"error\",function(data){ worker.onerror(data)});worker.on(\"exit\",function(data){})} worker.post
Message({\"cmd\": \"load\", \"urlOrBlob\": Module[\"mainScriptUrlOrBlob\"]|_scriptDir, \"wasmMemory\": wasmMe
memory, \"wasmModule\": wasmModule}),allocateUnusedWorker:function(){ var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){ if(PThread.unusedWorkers.length===0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){ var

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t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("\"Assertion failed: \"+UTF8ToString(condition)+", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]}}else if(typeof
dateNow!="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({"cmd":"processQueuedMainThreadWork"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread":targetThreadId,"cmd":"processThreadQueu
e"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd":"processThreadQueue"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret==="timed-out")return-
73;if(ret==="not-equal")return-6;if(ret==="ok")return
0;throw"Atomics.wait returned an unexpected value
\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)
==val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var

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ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){ var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmMemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emsripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e

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ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var

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canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ext["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcount){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao){return
ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffersWEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_draw"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===object)JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("

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EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
__pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"\Internal Error! spawnThread()
can only ever be called from main application thread!\";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"\Internal
error!\";if(!threadParams.pthread_ptr)throw"\Internal
error, no pthread ptr!\";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var

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stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread
_ptr };var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":thre
adParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthre
ad=function(){ msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current
environment does not support SharedArrayBuffer, pthreads are not available!\\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[(threadInfoStruct>>2)+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\\\"spawnThread\\\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=_pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\\\"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\\"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\\");}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread
pointer!\\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()===thread){err(\\"PThread
\\\"+thread+\\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()===thread){err(\\"Main
thread \\\"+thread+\\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread

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\"+thread+\", which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\"Attempted to join thread
\"+thread+\", which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\"cmd\": \"cleanupThread\", \"thread\": thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads

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_count"]=Module["asm\"][["E\"]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["asm\"][["F\"]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm\"][["G\"]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm\"][["H\"]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm\"][["J\"]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm\"][["K\"]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm\"][["L\"]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm\"][["M\"]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm\"][["N\"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm\"][["O\"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm\"][["P\"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm\"][["Q\"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm\"][["R\"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm\"][["S\"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm\"][["T\"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm\"][["U\"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm\"][["V\"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm\"][["W\"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm\"][["X\"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm\"][["Y\"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm\"][["Z\"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm\"][["_\"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm\"][["$\"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm\"][["aa\"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm\"][["ba\"]).apply(null,argument

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s});var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,arguments)};

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ts});var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(n

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ull,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][["_a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["f
b"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["g
b"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["as
m"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]
=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_proc
ess_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_
id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_ems
cripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).app

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ly(null,arguments));var
__emscripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=Module[\"asm\"][\"sb\"]).apply(n
ull,arguments)};var
__emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=function(){retur
n(__emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=Module[\"asm\
\"][\"tb\"]).apply(null,arguments)};var
__emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=function(
){return(__emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=
Module[\"asm\"][\"ub\"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module[\"__emscripten_call_on_thread\"]=function(){return(__emscripten_call_on_t
hread=Module[\"__emscripten_call_on_thread\"]=Module[\"asm\"][\"vb\"]).apply(null,arguments)};var
__emscripten_tls_init=Module[\"_emscripten_tls_init\"]=function(){return(__emscripten_tls_init=Module[\"_emscrip
ten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Mod
ule[\"__emscripten_thread_init\"]=Module[\"asm\"][\"xb\"]).apply(null,arguments)};var
stackSave=Module[\"stackSave\"]=function(){return(stackSave=Module[\"stackSave\"]=Module[\"asm\"][\"yb\"]).a
pply(null,arguments)};var
stackRestore=Module[\"stackRestore\"]=function(){return(stackRestore=Module[\"stackRestore\"]=Module[\"asm\
\"][\"zb\"]).apply(null,arguments)};var
stackAlloc=Module[\"stackAlloc\"]=function(){return(stackAlloc=Module[\"stackAlloc\"]=Module[\"asm\"][\"Ab\
\"]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module[\"_emscripten_stack_set_limits\"]=function(){return(__emscripten_stack_set
limits=Module[\"_emscripten_stack_set_limits\"]=Module[\"asm\"][\"Bb\"]).apply(null,arguments)};var
__memalign=Module[\"_memalign\"]=function(){return(__memalign=Module[\"_memalign\"]=Module[\"asm\"][\"Cb
\"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module[\"__emscripten_allow_main_runtime_queued_calls\"]=1
0512;var
__emscripten_main_thread_futex=Module[\"__emscripten_main_thread_futex\"]=12148;Module[\"cwrap\"]=cwrap
;Module[\"PThread\"]=PThread;Module[\"PThread\"]=PThread;Module[\"wasmMemory\"]=wasmMemory;Module
[\"ExitStatus\"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name=\"ExitStatus\";this.message=\"Program terminated with
exit(\"+status+\")\";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({\"cmd\":\"loaded\"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[\"calledRun\"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\"onRuntimeInitialized\"])Module[\"onRuntimeInitialized\"]();postRun(
)}if(Module[\"setStatus\"]){Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Mo
dule[\"setStatus\"](\"\"),1);doRun()},1)}else{doRun()}}Module[\"run\"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({\"cmd\":\"exitProcess\",\"returnCode\":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module[\"onExit\"])Module[\"onExit\"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[\"preInit\"]){if(typeof
Module[\"preInit\"]==\"function\")Module[\"preInit\"]=[Module[\"preInit\"]];while(Module[\"preInit\"].length>0){

```





```

_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }} var
arguments_=[];var thisProgram=\.\/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\/";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"\^"}else{scriptDirectory=__dirname+"\^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=
nodePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^");arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else
if(typeof arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("^")+1)}else{scriptDirectory="."}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key

```

in

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moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments\"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram\"];if(Module["quit\"])quit_=Module["quit\"];var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary\"];var
noExitRuntime=Module["noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
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Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"]((runDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return

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WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: \""+reason);abort(reason)}}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \""+reason);err(\"falling
back to ArrayBuffer
instantiateArrayBuffer(receiveInstantiatedSource)}))}}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscipten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscipten_get_heap_size(){return HEAPU8.length}function
emscipten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscipten_resize_heap(requestedSize){var oldSize=_emscipten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscipten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iow,iocnt,pnum){var num=0;for(var i=0;i<iocnt;i++){var ptr=HEAP32[iow+i*8>>2];var
len=HEAP32[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case

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44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1 }setErrNo(28);return-
1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"B\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"C\"]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"E\"]).apply(null,arguments
)};var
_Cosh=Module[\"_Cosh\"]=function(){return(_Cosh=Module[\"_Cosh\"]=Module[\"asm\"][\"F\"]).apply(null,argu
ments)};var

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_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][_"G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][_"H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][_"I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_"J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][_"K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][_"L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"_"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var

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_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var

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_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa\"]]
).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba\"]]
).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca\"]]
).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da\"]]
).apply(null,arguments)
);var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea\"]]
).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa\"]]
).apply(null,arguments)
);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga\"]]
).apply(n
ull,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][["Ha\"]]
).apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia\"]]
).apply(null,argume
nts));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][["Ja\"]]
).apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka\"]]
).apply(null,argument
s));var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La\"]]
).apply(null,argum
ents));var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma\"]]
).apply(null,argumen
ts));var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na\"]]
).apply(null,argu
ments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa\"]]
).apply(null,argumen
ts));var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa\"]]
).apply(null,ar
guments));var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["
Qa\"]]
).apply(null,arguments));var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["R
a\"]]
).apply(null,arguments));var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["Sa\"]]
).apply(null,arguments));var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta\"]]
).apply(nu
ll,arguments));var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua\"]]
).apply(null,argument
s));var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["Va\"]]
).apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa\"]]
).apply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][["Xa\"]]
).apply(null,arguments));var

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stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"
]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun(),1})else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}}run();\n\n return WasmBackendModule.ready\n\n);}\n\nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\nimport { backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasmModule,
WasmFactoryConfig } from './wasm-out/tfjs-backend-wasm';\nimport { BackendWasmThreadedSimdModule } from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport { wasmWorkerContents } from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++; \n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n
this.dataIdMap.set(\n
dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const
size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const
memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount});\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n if (values != null) {\n
this.wasm.HEAPU8.set(\n new Uint8Array(\n (values as backend_util.TypedArray).buffer,\n

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(values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n async
read(dataId: DataId): Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n
readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return
stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n
}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false
otherwise.\n * @param dataId\n * @param force Optional, remove the data regardless of refCount\n */\n
disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n
}\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n
this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n
refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n
 return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data =
this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n
return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n
case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new
Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,
size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n function
createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n
WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n
});\n });\n });\n return {};;\n }\n\n /**\n * Returns the path of the WASM binary.\n * @param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n
 simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null)
{\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n\n return wasmModuleFolder + path;\n }\n\n /**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n */\n * NOTE: We wrap the wasm module in a object with property

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'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n *^\nexport async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported,
 threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n *^\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n
};\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the '+\n 'bundled
js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-
bundlers';\n reject({message: rejectMsg});\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If
`wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported
&& wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob([\n [var
WasmBackendModuleThreadedSimd = `+\n wasmFactoryThreadedSimd.toString()],\n {type:
'text/javascript'}]);\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory
works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM
module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType:
string
= null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };;\n\n resolve({wasm: module});\n
});\n\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n
case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n
}\n\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-
backend-wasm-threaded-simd.wasm'\n] as const ;\n\n\nlet wasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the

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wasm backend is initialized. See https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers for more details.
@param path wasm file path or url
@param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.
@doc {heading: 'Environment', namespace: 'wasm'}
export function setWasmPath(path: string, usePlatformFetch = false): void {
 deprecationWarn('setWasmPath has been deprecated in favor of setWasmPaths and ' +
 ' will be removed in a future release. ');
 if (initAborted) {
 throw new Error('The WASM backend was already initialized. Make sure you call ' +
 'setWasmPath()' before you call `tf.setBackend()` or `tf.ready()`');
 }
 wasmPath = path;
 customFetch = usePlatformFetch;
}

/** Configures the locations of the WASM binaries.
 * `js`
 * setWasmPaths({
 * 'tfjs-backend-wasm.wasm': 'renamed.wasm',
 * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',
 * 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'
 * });
 * tf.setBackend('wasm');
 * `
 * @param prefixOrFileMap This can be either a string or object:
 * - (string) The path to the directory where the WASM binaries are located.
 * Note that this prefix will be used to load each binary (vanilla, SIMD-enabled, threading-enabled, etc.).
 * - (object) Mapping from names of WASM binaries to custom full paths specifying the locations of those binaries. This is useful if your WASM binaries are not all located in the same directory, or if your WASM binaries have been renamed.
 * @param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.
 * @doc {heading: 'Environment', namespace: 'wasm'}
export function setWasmPaths(prefixOrFileMap: string | {[key in WasmBinaryName]?: string}, usePlatformFetch = false): void {
 if (initAborted) {
 throw new Error('The WASM backend was already initialized. Make sure you call ' +
 'setWasmPaths()' before you call `tf.setBackend()` or `tf.ready()`');
 }
 if (typeof prefixOrFileMap === 'string') {
 wasmPathPrefix = prefixOrFileMap;
 } else {
 wasmFileMap = prefixOrFileMap;

 const missingPaths = wasmBinaryNames.filter(name => wasmFileMap[name] === null);
 if (missingPaths.length > 0) {
 throw new Error('There were no entries found for the following binaries: ' +
 `${missingPaths.join(',')}. Please either call setWasmPaths with a `map providing a path for each binary, or with a string indicating the directory where all the binaries can be found.`);
 }
 }
 customFetch = usePlatformFetch;
}

/** Used in unit tests.
export function resetWasmPath(): void {
 wasmPath = null;
 wasmPathPrefix = null;
 wasmFileMap = {};
 customFetch = false;
 initAborted = false;
 let threadsCount = -1;
 let actualThreadsCount = -1;
}

/** Sets the number of threads that will be used by XNNPACK to create threadpool (default to the number of logical CPU cores).
 * This must be called before calling `tf.setBackend('wasm')`.
export function setThreadsCount(numThreads: number) {
 threadsCount = numThreads;
}

/** Gets the actual threads count that is used by XNNPACK.
 * It is set after the backend is initialized.
export function getThreadsCount(): number {
 if (actualThreadsCount === -1) {
 throw new Error('WASM backend not initialized. ');
 }
 return actualThreadsCount;
}

/** @license See the LICENSE file.
 * This code is auto-generated, do not modify this file!
const version = '3.11.0';
export {version};
/** @license
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 * express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
import './flags_wasm';
import {registerBackend} from '@tensorflow/tfjs-core';
import {BackendWasm, init} from './backend_wasm';
export {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';
export {version as version_wasm} from './version';
const WASM_PRIORITY = 2;
registerBackend('wasm', async () => {
 const {wasm} = await init();
 return new

```

BackendWasm(wasm);\n},  
WASM\_PRIORITY);\n"],"names":["\_FusedMatMul","util","Abs","backend\_util","Add","AddN","Identity","setup",  
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W,GAAG,gBAAgB,CAAC;AACjC,CAAC;AAWD,IAAI,YAAAY,GAAG,CAAC,CAAC,CAAC;AACtB,IAAI,kBA  
AkB,GAAG,CAAC,CAAC,CAAC;AAE5B;,,,;SAmgB,eAAe,CAAC,UAAkB;IAChD,YAAAY,GAAG,UAAU,CA  
AC;AAC5B,CAAC;AAED;,,,;SAKgB,eAAe;IAC7B,IAAI,kBAAkB,KAAK,CAAC,CAAC,EAAE;QAC7B,MAA  
M,IAAI,KAAK,CAAC,+BAA+B,CAAC,CAAC;KACiD;IACD,OAAO,kBAAkB,CAAC;AAC5B;;ACxF;AAEA;I

ACM,OAAO,GAAG;;ACHhB;;,;,,,,,;AAiBA,wBacA;AALA,IAAM,aAAa,GAAG,CAAC,CAAC;AACxBC,w  
BA Ae,CAAC,MAAM,EAAE;;;oBACP,qBAAM,IAAI,EAAE,EAAA;;gBAApB,IAAI,GAAI,CAAA,SAAY,MAA  
hB;gBACX,sBAAO,IAAI,WAAW,CAAC,IAAI,CAAC,EAAE;;KAC9B,EAAE,aAAa,CAAC;;,;," }

Found

in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js.map

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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/starter/parcel/index.html

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 * limitations under the License.
 * =====
*/
/**
 * @deprecated Use `setWasmPaths` instead.
```



- \* Sets the path to the `.wasm`` file which will be fetched when the `wasm`
- \* backend is initialized. See
- \* <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>
- \* for more details.
- \* `@param path` `wasm` file path or url
- \* `@param usePlatformFetch` optional boolean to use platform fetch to download
- \* the `wasm` file, default to `false`.
- \*
- \* `@doc` {heading: 'Environment', namespace: 'wasm'}
- \*/

Found in path(s):

- \* `/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.js`

No license file was found, but licenses were detected in source scan.

```
{ "version":3,"file":"Max.js","sourceRoot":"","sources":["../src/kernels/Max.ts"],"names":[],"mappings":"AAAA;;;
;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAA4B,GAAG,EAAmC,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAI
zH,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,OAAO,EAAC,QAAQ,EAAC,MAAM,SAA
S,CAAC;AAEjC,IAAI,OACI,CAAC;AAET,SAAS,KAAK,CAAC,OAAoB;IACjC,OAAO,GAAG,OAAO,CAAC,I
AAI,CAAC,KAAK,CAAC,GAAG,EAAE,IAAI,CAAC,QAAQ,EAAE;QAC/C,QAAQ;QACR,QAAQ;QACR,QAA
Q;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,GAAG,CAAC,IAAgE;IAE3E,MAAM,EAAC
,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,gBAAgB,EAAE,IAAI,E
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AAC;KACTB;IAED,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,SAAS,GAAiB;IACrC,U
AAU,EAAE,GAAG;IACf,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IACb,UAAU,EAAE,GAAuB;C
ACpC,CAAC","sourcesContent":["/**\n
```

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport\n { BackendWasm } from './backend_wasm';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nimport\n { CppDType } from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)\n=>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null\n /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: { backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { reductionIndices: axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes,\n originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if\n (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input\n = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the\n transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n };\n}
```

Found

in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js.map

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```
{"version":3,"file":"tf-backend-wasm.fesm.min.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/Maximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts","../src/kernels/MirrorPad.ts","../src/kern
```

```

els/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression_util.ts", "../src/kernels/NonMaxSuppressionV3.ts",
../src/kernels/NonMaxSuppressionV4.ts", "../src/kernels/NonMaxSuppressionV5.ts", "../src/kernels/NotEqual.ts",
../src/kernels/OneHot.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kernels/PadV2.ts", "../src/kernels/Pow.ts",
../src/kernels/Prelu.ts", "../src/kernels/Prod.ts", "../src/kernels/Range.ts", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js",
../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kernels/ResizeBilinear.ts",
../src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/Round.ts", "../src/kernels/Rsqrt.ts",
../src/kernels/ScatterNd.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Sin.ts",
../src/kernels/Softmax.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Sqrt.ts",
../src/kernels/Square.ts", "../src/kernels/SquaredDifference.ts", "../src/kernels/Step.ts", "../src/kernels/StridedSlice.ts",
../src/kernels/Sub.ts", "../src/kernels/Sum.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kernels/Tile.ts",
../src/kernels/TopK.ts", "../src/kernels/Transform.ts", "../src/kernels/ZerosLike.ts", "../register_all_kernels.ts",
../src/kernels/Unpack.ts", "../src/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-wasm.js",
../src/backend_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js", "../src/version.ts", "../src/base.ts"], "sourcesContent": [
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 * limitations under the License.
 */
]
}

// This enum must align with the enum defined in cc/backend.h
export enum CppDType {
 float32 = 0,
 int32 = 1,
 bool = 2,
 string = 3,
 complex64 = 4
}

// Must match enum in cc/fusable_activations.h
export enum FusableActivation {
 linear = 0,
 relu = 1,
 relu6 = 2,
 prelu = 3,
 leakyrelu = 4,
 sigmoid = 5,
 elu = 6
}
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 */

import {
 _FusedMatMul,
 _FusedMatMulAttrs,
 _FusedMatMulInputs,
 KernelConfig,
 KernelFunc
} from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { FusableActivation } from './types';
let wasmFusedMatMul: (
 aId: number,
 aShape: Uint8Array,
 aShapeSize: number,
 bId: number,
 bShape: Uint8Array,
 bShapeSize: number,
 transposeA: boolean,
 transposeB: boolean,
 activation: number,
 biasId: number,
 preluActivationWeightsId: number,
 leakyreluAlpha: number,
 outId: number
) => void;
function setup(backend: BackendWasm) {
 wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, [
 'number', // a_id
 'array', // a_shape
 'number', // a_shape.length
 'number', // b_id
 'array', // b_shape
 'number', // b_shape.length
 'number', // transpose_a
 'number', // transpose_b
 'number', // activation
 'number', // biasId
 'number', // preluActivationWeightsId
 'number', // leakyreluAlpha
 'number' // out_id
]);
 function fusedBatchMatMul(
 args: {
 inputs: _FusedMatMulInputs,
 backend: BackendWasm,
 attrs: _FusedMatMulAttrs
 }
) {
 const { inputs, backend, attrs } = args;
 const { a, b, bias, preluActivationWeights } = inputs;
 if (a.dtype !== 'float32' || b.dtype !== 'float32') {
 throw new Error(`_FusedMatMul for non non-float32 tensors not yet supported.`);
 }
 const { transposeA, transposeB,

```

```

activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null)
{\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length != 1) {\n throw new
Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n
}\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\nFusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw
new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n
}\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n
wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,
transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): \n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, CCppType[x.dtype], outId);\n return out;\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'../unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n"/**\n * @license\n *
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agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from '../backend_wasm';
\n\nimport {CppType} from './types';
\n\nexport function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?: DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId: number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,\n b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CCppType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';
\n\nimport {createBinaryKernelConfig} from './binary_kernel';
\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from '../backend_wasm';
\n\nimport {CppType} from './types';
\n\nlet wasmFunc:\n (inputIds:
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Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const
 {inputs, backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n \n // Short-circuit
 zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n \n const inputIds =
 inputs.map(x => backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
 Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
 inputIds.length, CppDType[out.dtype], outId);\n \n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
 kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n\n"/**\n
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 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
 copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
 law
 or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
 =====\n
 *\n \nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
 {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
 identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
 args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
 const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n \n export const
 identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n
 kernelFunc: identity as {} as KernelFunc,\n }; \n "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
 Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
 except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
 =====\n
 *\n \nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from
 './Identity';\nimport {CppType}
 from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
 CppDType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:
 BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n
 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n
 'number', // perm.length\n]);\n}\n\nexport function transpose(\n args: {\n inputs: TransposeInputs, backend:
 BackendWasm, attrs: TransposeAttrs):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n // Reduce any
 dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n
 const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n \n let permIsNoOp = true;\n for
 (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp
 = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId:
 inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n if (permIsNoOp) {\n const cloned =
 identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n const out =
 backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =

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'./kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,
number']);\n}\n\nfunction all(args: { backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====\n
*/\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n TensorInfo {\n const { backend,
inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize: number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n\n function argmax(\n args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let\n inputId = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n // will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n }\n\n export const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n\n kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n }; //**\n }\n\n @license\n Copyright 2019 Google LLC. All Rights Reserved.\n Licensed under the Apache License, Version 2.0 (the \"License\");\n you may not use this file except in compliance with the License.\n You may obtain a copy of the License at\n http://www.apache.org/licenses/LICENSE-2.0\n Unless required by applicable law or agreed to in writing,\n software\n distributed under the License is distributed on an \"AS IS\" BASIS,\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n See the License for the specific language governing permissions and\n limitations under the License.\n *\n =====\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n\n function avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n\n const x = inputs.x as Tensor4D;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,\n dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n }\n\n =====
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const strideWidth = convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat
!=='channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat:` +\n
`${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 ||
convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend only supports average pooling with
dilation = [1, 1],`
+ \n `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` + \n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount
for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
kernelFunc: reshape as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number' // out_id\n]);\n}\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n\n
const
{transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const

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bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n
util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions
 must either be the `+\n `same or at least one input batch dimension must be 1. Got input `+\n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and `+\n `${innerShapeB}) of Tensors with shapes
${a.shape} and `+\n `${b.shape} and transposeA=${transposeA}` `+\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation
is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape:
a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n\n
backend.disposeData(b3d.dataId);\n\n out.shape
= outShape;\n return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName:
BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====\\n
*/\nimport { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport
{ assertNotComplex } from './cpu_util';\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n const
isContinous = slice_util.isSliceContinous(shape, begin, size);\n const length = util.sizeFromShape(size);\n const
xStrides = util.computeStrides(shape);\n if (isContinous) {\n const flatOffset =
slice_util.computeFlatOffset(begin, xStrides);\n if (dtype === 'string') {\n return vals.slice(flatOffset,
flatOffset + length);\n }\n return vals.subarray(flatOffset, flatOffset + length);\n }\n const decodedData
= dtype === 'string' ?\n backend_util.fromUint8ToStringArray(vals) :\n vals;\n const inBuf =
buffer(shape, dtype, decodedData);\n const outBuf = buffer(size, dtype);\n for (let i = 0; i < outBuf.size; ++i) {\n
const outLoc = outBuf.indexToLoc(i);\n const inLoc = outLoc.map((idx, j) => idx + begin[j]);\n
outBuf.set(inBuf.get(...inLoc), ...outLoc);\n

```





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```

=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { sliceImplCPU } from
'./kernel_utils/shared';\n\nexport function slice(\n args: { inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm }) {\n const { inputs: { x }, attrs: { begin, size }, backend } = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous
= slice_util.isSliceContinuous(x.shape, begin_, size_);\n const xVals = backend.readSync(x.dataId);\n const out =
backend.makeOutput(size_, x.dtype);\n const xStrides = util.computeStrides(x.shape);\n const outData =
backend.dataIdMap.get(out.dataId);\n\n if (isContinuous) {\n const flatOffset =
slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n(xVals as Uint8Array[])\n .slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n } else {\n const
outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray)\n .subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));\n }\n\n return out;\n }\n\n if (x.dtype ===
'string') {\n const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as
Uint8Array[];\n return out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const
rank = x.shape.length;\n if (rank === 2) {\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as
[number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as
TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number,
number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n begin_ as [number, number, number, number],\n size_ as [number, number, number,
number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride:
number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n\n const endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction
slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:
backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <
endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:
backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n\n for (let i
= beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n
const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset,
xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n}\n}\n\nexport const sliceConfig:
KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as {\n\n KernelFunc,\n};\n};\n", "/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the

```

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OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language  
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```
=====
*/n/nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc } from '@tensorflow/tfjs-core';n/nimport { BackendWasm } from './backend_wasm';n/nimport
{ reshape } from './Reshape';n/nimport { slice } from './Slice';n/nimport { transpose } from './Transpose';n/nfunction
batchToSpaceND(args: {n inputs: BatchToSpaceNDInputs,n backend: BackendWasm,n attrs:
BatchToSpaceNDAttrs\n}) {n const
 {inputs, backend, attrs} = args;n const {x} = inputs;n const {blockShape, crops} = attrs;n/n const prod =
 blockShape.reduce((a, b) => a * b);n/n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);n
 const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);n const reshapedPermuted =n
 backend_util.getReshapedPermuted(x.shape, blockShape, prod);n const sliceBeginCoords =n
 backend_util.getSliceBeginCoords(crops, blockShape.length);n const sliceSize =n
 backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);n/n const xReshaped = reshape({inputs:
 {x}, backend, attrs: {shape: reshaped}});n const xTransposed =n transpose({inputs: {x: xReshaped}, backend,
 attrs: {perm: permuted}});n const xTransposedReshaped = reshape(n {inputs: {x: xTransposed}, backend,
 attrs: {shape: reshapedPermuted}});n const result = slice({n inputs: {x: xTransposedReshaped},n backend,n
 attrs: {begin: sliceBeginCoords,
 size: sliceSize}\n });n/n backend.disposeData(xReshaped.dataId);n backend.disposeData(xTransposed.dataId);n
 backend.disposeData(xReshaped.dataId);n/n return result;n}\n\nexport const batchToSpaceNDConfig:
KernelConfig = {n kernelName: BatchToSpaceND,n backendName: 'wasm',n kernelFunc: batchToSpaceND as
{ } as KernelFunc\n};n"/**n * @licensen * Copyright 2019 Google LLC. All Rights Reserved.n * Licensed
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```

```
=====
*/n/nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';n/nimport
{ TensorInfo } from '@tensorflow/tfjs-core';n/nimport { BackendWasm } from './backend_wasm';n/nexport function
cast(n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):n TensorInfo {n const {inputs:
 {x}, attrs: {dtype}, backend} = args;n const out = backend.makeOutput(x.shape, dtype);n const inVals =
 backend.toArrayFromHeap(x);n const outVals = backend.toArrayFromHeap(out);n outVals.set(inVals);n
 return out;n}\n\nexport const castConfig: KernelConfig = {n kernelName: Cast,n backendName: 'wasm',n
 kernelFunc: cast as { } as KernelFunc\n};n"/**n * @licensen * Copyright 2021 Google LLC. All Rights
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 BASIS,n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.n * See the
 License for the specific language governing permissions andn * limitations under the License.n *
```

```
=====
*/nimport { KernelConfig, Ceil } from '@tensorflow/tfjs-core';nimport { createUnaryKernelConfig } from
```

```

'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:
BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const
 {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId
= backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return
out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n };
", "/*\n * @license\n * Copyright 2019
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OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { concatImplCPU } from
 '../kernel_utils/shared';\n\nimport { identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nexport function
concat(\n args: {\n inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs\n }) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t => t.shape);\n\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n\n return reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t
=> {\n return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along
axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const
 simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n

```







```

*/\n\nimport {backend_util,
Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId: number, batchSize:
number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,
padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n
dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels:
number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n
'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number',
// padLeft\n
'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n
'number', // outId\n]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:
Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n
 const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth, padTop,
padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n\nimport
{backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,
KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n

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xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number',
 // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', //
inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', //
outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', //
leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n
'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n
'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n
]);\n}\n\nfunction conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs:
Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n const dilations = 1;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast
 ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const xChannelStride =
isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride = isChannelsLast ?
dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride =
isChannelsLast ? 1 : dyStrides[1];\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId
= backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport
const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig}
from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n *
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```

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```
=====
*
\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
 './unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 */
```

```
=====
*
\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast }
 from './Cast';\n// Must match enum in CropAndResize.cc\nenum
 InterpolationMethod {
 bilinear = 0,
 nearest = 1
 }\nlet wasmCropAndResize: (imagesId: number,
boxesId: number, boxIndId: number, numBoxes: number,
imagesShape: Uint8Array, cropHeight: number,
cropWidth: number, method: number, extrapolationValue: number, outId: number) => void;\nfunction
setup(backend: BackendWasm): void {
 wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null
 /*void*/, [
 'number', // imagesId
 'number', // boxesId
 'number', // boxIndId
 'number', // numBoxes
 'array', // images shape
 'number', // cropHeight
 'number', // cropWidth
 'number', // method
 'number', // extrapolation value
 'number' // out id
]);\nfunction cropAndResize(args: {
 backend: BackendWasm,
 inputs: CropAndResizeInputs,
 attrs: CropAndResizeAttrs
}): TensorInfo {
 const { backend,
 inputs, attrs } = args;
 const { method, extrapolationValue, cropSize } = attrs;
 const { image,
 boxes, boxInd } = inputs;\n const numBoxes = boxes.shape[0];
 const [cropHeight, cropWidth] = cropSize as
 [number, number];
 const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imageData =
 backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {
 castedData =
 cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' } });
 imageData =
 backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imageData.id;\n const boxesId =
 backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const
 out = backend.makeOutput(outShape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;\n const
 imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n wasmCropAndResize(
 imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,
 cropWidth,
 InterpolationMethod[method as { } as keyof typeof InterpolationMethod],
 extrapolationValue, outId);\n if (castedData !== null) {
 backend.disposeData(castedData.dataId);\n }\n return out;\n}\nexport const cropAndResizeConfig: KernelConfig = {
 kernelName: CropAndResize,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: cropAndResize as { } as KernelFunc
};
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 */
```

```
=====
*
\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util }
 from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from
 './types';\nimport { transpose } from './Transpose';\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,
finalDim: number, outId: number, dtype: CppDType) => void;\nfunction setup(backend:
BackendWasm) {
 wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [
 'number', // x_id
```

```

'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //
dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n util.assert(x.dtype
=== 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM
backend`);\n // permute required axis to inner most axis\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',
[permutedAxis], xRank);\n\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n
const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation
!== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out =
transpose(\n {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n
backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: cumsum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n
]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n
attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const
{blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const outputHeight = inputHeight *
blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize *
blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth,
outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out =
backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId =
xData.id;\n const xStridesBytes
=\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n

```

```

const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n
wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n
return
out;\n}\n\n
export const depthToSpaceConfig: KernelConfig = {\n
kernelName: DepthToSpace,\n
backendName:
'wasm',\n
setupFunc: setup,\n
kernelFunc: depthToSpace as { } as KernelFunc\n};\n\n
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language governing permissions and\n * limitations under the License.\n *
=====
*/\n\n
import {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n
import
{BackendWasm} from './backend_wasm';\n\n
let wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth:
number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n
outId: number) => void;\n\n
function setup(backend: BackendWasm) {\n
wasmDepthwiseConv2d =\n
backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n
'number', // xId\n
'number', //
batchSize\n
'number', // inputHeight\n
'number', // inputWidth\n
'number', // filterId\n
'number', //
filterHeight\n
'number', // filterWidth\n
'number', // padTop\n
'number', // padRight\n
'number', //
padBottom\n
'number', // padLeft\n
'number', // isSamePad\n
'number', // dilationHeight\n
'number', // dilationWidth\n
'number', // strideHeight\n
'number', // strideWidth\n
'number', //
inputChannels\n
'number', // outputChannels\n
'number', // outId\n
]);\n\n
function
depthwiseConv2d(args: {\n
inputs: DepthwiseConv2dNativeInputs,\n
backend: BackendWasm,\n
attrs: DepthwiseConv2dNativeAttrs\n}) {\n
const {inputs, attrs, backend} = args;\n\n
const {x, filter} = inputs;\n\n
const xId = backend.dataIdMap.get(x.dataId).id;\n\n
const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n\n
const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n\n
const $dilations = dilations === null ? [1, 1] : dilations;\n\n\n
const convInfo = backend_util.computeConv2DInfo(\n
(x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n
($dilations as number | [number, number]), pad,
dimRoundingMode,\n
true /* depthwise */);\n\n\n
const filterHeight = convInfo.filterHeight;\n\n
const filterWidth =
convInfo.filterWidth;\n\n
const padTop = convInfo.padInfo.top;\n\n
const padRight = convInfo.padInfo.right;\n\n
const
padBottom = convInfo.padInfo.bottom;\n\n
const padLeft = convInfo.padInfo.left;\n\n
const dilationHeight =
convInfo.dilationHeight;\n\n
const dilationWidth = convInfo.dilationWidth;\n\n
const strideHeight =
convInfo.strideHeight;\n\n
const strideWidth = convInfo.strideWidth;\n\n
const inputChannels = convInfo.inChannels;\n\n
const outputChannels
= convInfo.outChannels;\n\n
const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n\n
if
(convInfo.dataFormat !== 'channelsLast') {\n
throw new Error(\n
`wasm backend DepthwiseConv2dNative
does not support dataFormat:` +\n
` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n
}\n\n
const out =
backend.makeOutput(convInfo.outShape, 'float32');\n\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmDepthwiseConv2d(\n
xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n
filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n
dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n
outputChannels, outId);\n\n
return out;\n}\n\n
export const depthwiseConv2dNativeConfig:
KernelConfig = {\n
kernelName: DepthwiseConv2dNative,\n
backendName: 'wasm',\n
setupFunc: setup,\n
kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n\n
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```
=====\n*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n"/**\n * @license\n * Copyright
```

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```
=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright
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```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from\n './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const\n {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape =\n input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs:\n {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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```



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```
=====\n*\n\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { Fill, FillAttrs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function fill(args: { attrs: FillAttrs, backend: BackendWasm }) {\n const { attrs: { shape, value, dtype }, backend } = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n"/**\n
```

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```
=====\n*\n\nimport { FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: { inputs: FlipLeftRightInputs, backend: BackendWasm }): TensorInfo {\n const { inputs, backend } = args;\n const { image } = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as KernelFunc,\n setupFunc: setup;\n};\n"/**\n
```

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```
=====\n*\n\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from '../unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n"/**\n @license\n * Copyright 2019
```

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```
=====\n
```

```

*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019
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=====
*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
 TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
 wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
 varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
 'number', 'number', 'number', 'number', 'number'];\n)\n\nfunction fusedBatchNorm(args: {\n backend:
 BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
 {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
 inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
 backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const
 offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
 backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) ===
 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId,
 meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const
fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations
 under the License.\n *
=====
*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
 Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
 {FusableActivation} from './types';\n\nlet wasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight:
 number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,
 padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,
 dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n
inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number,
 leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /*
void */,\n [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n
'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //

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strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number',
// preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n);\n)\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n dataFormat,\n
dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {}] as keyof typeof
FusableActivation;\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet
supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n if
(biasData.shape[0] !== outputChannels)
{\n throw new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the
number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const
inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend
FusedConv2D does not
support dataFormat:` +\n ` ${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number,
filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom:
number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number,

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strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation:
number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number',
// dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias,
preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
 dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
 pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation
as {}] as keyof typeof FusableActivation;\n if (fusedActivation == null) {\n throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}`);\n }\n\n
if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedDepthwiseConv2D bias shape\n (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n }\n\n
 biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights ==
null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n
xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight,
strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0,
outId);\n\n return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:
FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

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=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n
 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend:
BackendWasm, inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params,
indices} = inputs;\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n const out = backend.makeOutput(resultShape,
params.dtype);\n if (numSlices === 0) {\n return out;\n }\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId =
indicesData.id;\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,\n
numSlices, sliceRank, sliceSize,\n
 stridesBytes, outId);\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName:
GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig,
KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n // Throw error when any
index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals =
backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i <
indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >=
0,\n () =>\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n const
shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n
 backend\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length

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- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n
backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape = shapeInfo.outputShape;\n return
out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from
'/types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n]);\n}\n\nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n }\n\n return out;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n

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backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc,\n);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the\n \* \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the\n \* License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or\n \* agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for\n \* the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n *\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport { KernelConfig, LogicalAnd }\nfrom '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst\nsupportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n *
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*\n\nimport {backend_util,
KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport
{CppType} from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)
=>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null
/*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n
]);\n}\n\nfunction max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed)
 {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',
axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig:
KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n *
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool:
(\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number,
filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight:
number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number,
outputChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //

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dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number',
// inputChannels\n 'number', // outputChannels\n 'number', // outId\n
 });\n}\n\nfunction maxPool(\n args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n\n // TF API supports int32 input. CPU and WebGL backend also support
int32\n // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n //\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n //\n // TODO: add
support for int32 input.\n util.assert(\n x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32
input is supported. Got ${x.dtype}.`);\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const
convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,
dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !==
'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: ` +\n
`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast}
from './Cast';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n
 // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n
 inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n
cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =

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backend.dataIdMap.get(castedInput.dataId).id;\n } \n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n } \n\n if (inputWasTransposed) {\n
// dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n } \n\n if (keepDims) {\n //
reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n } \n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n } \n\n return
out;\n } \n\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: mean as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction min(args: { backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n
const { axis, keepDims } = attrs;\n const { x }
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{ transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n } \n\n } \n\n const inputRank = input.shape.length;\n\n
backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize,
outId);\n } \n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n } \n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n } \n\n return
out;\n } \n\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: min as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\n

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createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/\*\n \* @license\n \* Copyright 2021 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode { \n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction\n setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', //\n mode\n 'number', // outId\n]);\n\n function mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n }) {\n const { inputs: { x }, backend, attrs: { paddings, mode } } = args;\n const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n wasmMirrorPad(\n xId, xShapeBytes, x.shape.length,\n CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,\n MirrorPaddingMode[mode], outId);\n return out;\n }\n\n export const mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {\n }\n as KernelFunc,\n setupFunc:\n setup\n };\n }\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport\n { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const\n multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport
```

```

{createUnaryKernelConfig} from './unary_kernel';\nexport const negConfig: KernelConfig =
createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n
 pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs:
number;\n}\n\n/*\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`\n *\n\nexport
function parseResultStruct(\n backend: BackendWasm, resOffset: number): Result {\n const result = new
Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const pSelectedIndices = result[0];\n const
selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs = result[3];\n // Since the
result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n\n", "/*\n * @license\n * Copyright 2019
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http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n 'number', // Result*\n [\n
 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', //
iouThreshold\n 'number', // scoreThreshold\n]);\n}\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor
 =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```

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```
=====
*/
import {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {parseResultStruct} from './NonMaxSuppression_util';
let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean) => number;
function setup(backend: BackendWasm): void {
 wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV4, 'number', // Result*
 ['number', // boxesId, 'number', // scoresId, 'number', // maxOutputSize, 'number', // iouThreshold, 'number', // scoreThreshold, 'bool', // padToMaxOutputSize]);
 function nonMaxSuppressionV4(args: {backend: BackendWasm, inputs: NonMaxSuppressionV4Inputs, attrs: NonMaxSuppressionV4Attrs}): TensorInfo[] {
 const {backend, inputs, attrs} = args;
 const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} = attrs;
 const {boxes, scores} = inputs;
 const boxesId = backend.dataIdMap.get(boxes.dataId).id;
 const scoresId = backend.dataIdMap.get(scores.dataId).id;
 const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize);
 const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);
 // Since we are not using scores for V4, we have to delete it from the heap.
 backend.wasm._free(pSelectedScores);
 const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
 const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);
 return [selectedIndicesTensor, validOutputsTensor];
 }
 export const nonMaxSuppressionV4Config: KernelConfig = {kernelName: NonMaxSuppressionV4, backendName: 'wasm', setupFunc: setup, kernelFunc: nonMaxSuppressionV4 as {}} as KernelFunc;
}
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 * limitations under the License.
 */
=====
```

```
*/
import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {parseResultStruct} from './NonMaxSuppression_util';
let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number, softNmsSigma: number) => number;
function setup(backend: BackendWasm): void {
 wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV5, 'number', // Result*
 ['number', // boxesId, 'number', // scoresId, 'number', // maxOutputSize, 'number', // iouThreshold, 'number', // scoreThreshold, 'number', // softNmsSigma]);
 function kernelFunc(args: {backend: BackendWasm, inputs: NonMaxSuppressionV5Inputs, attrs: NonMaxSuppressionV5Attrs}): TensorInfo[] {
 const {backend, inputs, attrs} = args;
 const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;
 const {boxes, scores} = inputs;
 const boxesId = backend.dataIdMap.get(boxes.dataId).id;
 const scoresId = backend.dataIdMap.get(scores.dataId).id;
 const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);
 const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);
 // Since we are
```

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not using validOutputs for V5, we have to delete it from the
// heap.\n backend.wasm._free(pValidOutputs);\n\n
const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2020
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=====
\n
*\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmOneHot
= backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', //
onValue\n 'number', // offValue\n 'number' // out_id\n]);\n}\n\nfunction oneHot(\n args: {inputs:
OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const
{indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig:
KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
{ } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(1);\n return

```

```

out;\n)\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc\n};\n", "/\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null / void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n}\n\nfunction pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
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 new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
 Uint8Array(new
 Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
 CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
 KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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 =====\n
 *\nimport { KernelConfig, Pow } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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 =====\n
 *\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport
 { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nlet wasmPrelu: (xId: number,
 weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
 backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
 out_id\n]);\n\n function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n const { inputs, backend }
 = args;\n const { x, alpha } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
 backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
 (input.dtype !== 'float32') {\n castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' });\n inputId =
 backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
 kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
 KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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 implied.\n * See the License for the specific language governing
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 =====\n
 *\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from
 '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport
 { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n
 xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:

```







```

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=====
*\n
*\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n",/**\n * @license\n * Copyright 2019 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n
*\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n",/**\n * @license\n
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=====
*\n
*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport
{createUnaryKernelConfig} from './unary_kernel';\n\nexport const relu6Config: KernelConfig =
createUnaryKernelConfig(Relu6);\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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=====
*\n
*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {cast} from './Cast';\n\nlet wasmResizeBilinear: (\n xId:
number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,
newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null
/*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n
'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n
'number', // halfPixelCenters\n 'number' // outId\n]);\n\n function resizeBilinear(args: {\n backend:
BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters,

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size} = attrs;\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n"/**\n *
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=====
*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n]);\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length
=== 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //

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batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', //
centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n}\n\nexport function
rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs:
RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const
{radians, fillValue, center} = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const
imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n"/**\n * @license\n * Copyright 2021
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=====\n
*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n"/**\n *
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specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n"/**\n *
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*\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppDType} from
'/types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //

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sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n
'number' // outId\n]);\n}\n\nfunction scatterNd(\n args:\n {backend: BackendWasm, inputs:
ScatterNdInputs, attrs:
 ScatterNdAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n
const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape)
=== 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n
scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,
stridesBytes, outputSize, outId);\n\n return out;\n }\n\n\nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n backendName: 'wasm',\n
 setupFunc: setup,\n kernelFunc: scatterNd as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number,
eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number',
// eId\n 'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :
util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\n\nexport
const
selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { } as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm}
from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs});\n TensorInfo {\n
const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =

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backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n
return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: {\n backend: BackendWasm,\n
inputs: SoftmaxInputs, attrs: SoftmaxAttrs\n }):\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google
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=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {padV2Config} from
'./PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n }) {\n const {inputs, backend,

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attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod =
util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const
reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n"/**\n * @license\n *
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the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs,
attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s
=> {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as {} as
KernelFunc\n};\n"/**\n * @license\n *
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the License.\n *
=====\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"/**\n * @license\n *
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```
=====\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on\n an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep:\n(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {\n backend: BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from
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./Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction\n setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n}\n\nexport function stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus\n reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||\n isSimpleSlice) {\n // Optimization #2, slice is memory contiguous\n (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate\n begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:\n {begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,\n 'float32');\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new\n Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new\n Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const\n stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const outputShapeBytes =\n new\n Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n new\n Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,\n beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n backend.disposeData(out.dataId);\n }\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License\n at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is\n distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under

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=====\n\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:\n number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:\n SumAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const\n {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const\n {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,\n reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize\n = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as { } as KernelFunc\n }; \n /**\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not\n use this file
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=====\n\n*\n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * \n
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=====\n\n*\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (\n xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:\n number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTile =\n backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //\n x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n\n function tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return\n out;\n }\n\n export const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2020 Google LLC.\n * All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use\n * this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n * \n */\n}
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-\ncore';\nimport\n{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTopK:\n(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:\n boolean,\n outValuesId: number,\n outIndicesId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',\n // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk:\n (\n args: {inputs: TopKInputs, backend: BackendWasm,\n attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes\n = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =\n backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length,\n CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: topk as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2021 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n * \n */\n}
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=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { image, transforms } = inputs;\n const { interpolation, fillMode, fillValue, outputShape } = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth, numChannels] as [number, number, number, number];\n const strides =\n new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape, image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n }\n\n export const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n }; \n "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend: BackendWasm }) {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as { } as KernelFunc,\n}; \n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the\nlibrary. A modular build would replace\n// the contents of this file and import only the kernels that are\nneeded.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}\nfrom './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from\n './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport\n {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}\nfrom './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport\n {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport\n {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from\n './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from\n './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport\n {cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig}\nfrom './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport\n {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from\n './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from\n './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from\n './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from\n './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig}\nfrom './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport\n {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from\n './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport\n {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport\n {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport\n {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport\n {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport\n {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport\n {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport\n {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from\n './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from\n './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from\n './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from\n './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from\n './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}\nfrom './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from\n './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from\n './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport\n {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}\nfrom './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from\n './kernels/Reshape';\nimport\n {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport\n {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from\n './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from\n './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from\n './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
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{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig}
 from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from
 './kernels/Tanh';\nimport {tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport
 {transformConfig} from './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport
 {unpackConfig} from './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel
 configs here\nconst kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n
 registerKernel(kernelConfig);\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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 * =====\n
 *\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {slice} from
 './Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\n
 TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
 0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank =
 value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
 Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length;\n i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size}, backend});\n }\n return
 outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig
 = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as {} as KernelFunc,\n};\n\n"/**\n *

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=====\n *^\\nimport {env} from '@tensorflow/tfjs-core';\\nconst ENV = env();\\n/**\\n * True if SIMD is supported.\\n */\\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\\nENV.registerFlag(\\n // This typed array passed in to WebAssembly.validate is WebAssembly binary\\n // code. In this case it is a small program that contains SIMD\\n // instructions.\\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([\\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11\\n]));\\n/**\\n * True if threads are supported.\\n */\\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\\n // TODO(annxingyuan): Enable node support once this is resolved:\\n // https://github.com/tensorflow/tfjs/issues/3830\\n if (ENV.get('IS_NODE')) {\\n return false;\\n }\\n try {\\n // Test for transferability of SABs (needed for Firefox)\\n // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkZIHETpA/dwsMNchWEQAJ\\n new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\\n // This typed array is a WebAssembly program containing threaded\\n // instructions.\\n return WebAssembly.validate(new Uint8Array([\\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11\\n]));\\n } catch (e) {\\n return false;\\n }\\n});\\n", "\\nvar WasmBackendModuleThreadedSimd = (function() {\\n var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\\n return (\\nfunction(WasmBackendModuleThreadedSimd) {\\n WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};\\n\\nfunction GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}return HEAP8}function GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}return HEAPU8}function GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}return HEAP32}function GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}return HEAPU32}function GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}return HEAPF64}var Module=typeof WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var readyPromiseResolve,readyPromiseReject;Module["ready"]=new Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var moduleOverrides={};var key;for(key in Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var thisProgram=\\.this\\.program\\.;var quit_=function(status,toThrow){throw toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof window==="object";ENVIRONMENT_IS_WORKER=typeof importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof process\\.versions==="object"&&typeof
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process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"\\\")}arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inps
ect\"]=function(){return\"[Emscripten Module object]\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\"worker_threads\")}catch(e){console.error(\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print} }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\"undefined\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!=\"0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret} }else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror()} ;xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }if(ENVIRONMENT_IS_NODE){if(typeof
performance===\"undefined\"){global.performance=require(\"perf_hooks\").performance} }var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in

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moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){abort(\"no
native wasm support detected\")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort(\"Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \"+ident+\", make sure
it is exported\");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\"string\":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\"array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!=\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function

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alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMem
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return

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String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return
response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-
instantiate")})))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(rejectPromise);return{}}var
ASM_CONSTS={10520:function(){throw"Canceled!"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0}}};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===function"){callback(Module);continue}var func=callback.func;if(typeof
func===number){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSYS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM

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:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emscripten_futex_wake\"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker(pthread_ptr)=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\":\":cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}};initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()};if(ENVIRONMENT_IS_PTHREAD&&pthread_ptr)__pthread
_tsd_run_dtors();runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);__emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var

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tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\":"exit"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\":"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+'\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d["thread"])}}else
if(cmd===\"killThread\"){killThread(d["thread"])}}else
if(cmd===\"cancelThread\"){cancelThread(d["thread"])}}else
if(cmd===\"loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\"print\"){out(\"Thread \"+d["threadId"]+\": \"+d["text"])}}else
if(cmd===\"printErr\"){err(\"Thread \"+d["threadId"]+\": \"+d["text"])}}else if(cmd===\"alert\"){alert(\"Thread
\"+d["threadId"]+\": \"+d["text"])}}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}}else
if(cmd===\"exitProcess\"){try{exit(d["returnCode"])}}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\'"+cmd)\'}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\":\"+e.lineno+\":
\'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\"message\",function(data){worker.onmessage({data:d
ata})});worker.on(\"error\",function(data){worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post

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Message({"cmd\":"load\","urlOrBlob\":"Module["mainScriptUrlOrBlob\"]|_scriptDir,\"wasmMemory\":"wasmMemory,\"wasmModule\":"wasmModule"}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnusedWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function
getNoExitRuntime(){return noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function
invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessage
({\"cmd\":"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":"targetThreadId,\"cmd\":"processThreadQueue
\"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return worker.postMessage({\"cmd\":"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atomics.wait returned an unexpected value
\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return

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navigator[\"hardwareConcurrency\"]}function
_emsripten_proxy_to_main_thread_js(index, sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index, serializedNumCallArgs, args, sync);stackRestore(stack);return
ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr, buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index, numCallArgs, args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null, _emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmMemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize, requestedSize
+100663296);var
newSize=Math.min(maxHeapSize, alignUp(Math.max(requestedSize, overGrownHeapSize), 65536));var
replacement=emsripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0, removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1; i>=0; --
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]}, registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}}, deferredCalls:[], deferCall:function(targetFunction, precedence
, argsList){function arraysHaveEqualContent(arrA, arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList, args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction, precedence:precedence, argsList:argsList
});JSEvents.deferredCalls.sort(function(x, y){return
x.precedence<y.precedence})}, removeDeferredCalls:function(targetFunction){for(var
i=0; i<JSEvents.deferredCalls.length; ++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i, 1); --i}}, canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls}, runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0; i<JSEvents.deferredCalls.length; ++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i, 1); --
i; call.targetFunction.apply(null, call.argsList)}, eventHandlers:[], removeAllHandlersOnTarget:function(target, event
TypeString){for(var
i=0; i<JSEvents.eventHandlers.length; ++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i-
)}}}, _removeHandler:function(i){var

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h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThre
ad,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return"";if(target==window)return"#window";
if(target==screen)return"#screen";return
target&&target.nodeName?target.nodeName:""},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):"";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThre
ad,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var

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targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emscripten_set_current_thread_status(newStatus){}function
_emscripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("\ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("\OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("\WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("\WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32)[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\undefined\||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[contex
tHandle])GL.currentContext=null;if(typeof

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JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"\\\"){name=name.slice(0,name.lastIndexOf(\"\\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+\"[\"+j+\"]\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=[\"default\", \"low-power\", \"high-performance\"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\"alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\"depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\"stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iow,iocnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iow,iocnt,pnum);var num=0;for(var i=0;i<iocnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function

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pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}function spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread() can only ever be called from main application thread!";var worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var stackHigh=threadParams.stackBase+threadParams.stackSize;var pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread_ptr};var tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);Atomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),tis+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var global_libc=_emscripten_get_global_libc();var global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthread=pthread;var msg={"cmd":"run","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":threadParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthread=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList);if(worker.loaded){worker.runPthread();delete worker.runPthread}}function pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer==="undefined"){err("Current environment does not support SharedArrayBuffer, pthreads are not available!");return 6}if(!pthread_ptr){err("pthread_create called with a null thread pointer!");return 28}var transferList=[];var error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return _emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_ptr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_PTHREAD){threadParams.cmd="spawnThread";postMessage(threadParams,transferList)}else{spawnThread(threadParams)}return 0}function pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var tb=pthread_self();if(!tb)return;var cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw"Canceled!"}function _emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKER)return;warnOnce("Blocking on the main thread is very dangerous, see https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread")}function

```

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__emscripten_do_pthread_join(thread,status,block){if(!thread){err("\pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err("\PThread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err("\Main
thread \"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err("\pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("\Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd": "\cleanupThread", "thread": thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}_pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\object")return
navigator[\hardwareConcurrency"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\e__:__assert_fail,\r__:__call_main,\x__:__emscripten_notify_thread_queue,\b__:_abort,\y__:
_emscripten_asm_const_int,\j__:_emscripten_conditional_set_current_thread_status,\d__:_emscripten_futex_wait,\
c__:_emscripten_futex_wake,\f__:_emscripten_get_now,\p__:_emscripten_memcpy_big,\A__:_emscripten_num_l
ogical_cores,\u__:_emscripten_receive_on_main_thread_js,\q__:_emscripten_resize_heap,\v__:_emscripten_set_ca
nvas_element_size,\i__:_emscripten_set_current_thread_status,\s__:_emscripten_set_thread_name,\w__:_emscrip
ten_webgl_create_context,\l__:_fd_close,\n__:_fd_seek,\g__:_fd_write,\o__:initPthreadsJS,\a__:wasmMemory||Mo
dule[\wasmMemory],\z__:_pthread_cleanup_pop,\k__:_pthread_cleanup_push,\h__:_pthread_create,\m__:_pthr
ead_join,\t__:_sysconf};var asm=createWasm();var

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__wasm_call_ctors=Module["__wasm_call_ctors"]=function(){return(__wasm_call_ctors=Module["__wasm
_call_ctors"]=Module["asm"]["B"]).apply(null,arguments)};var
_init=Module["_init"]=function(){return(_init=Module["asm"]["C"]).apply(null,arguments)};
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Mod
ule["_init_with_threads_count"]=Module["asm"]["D"]).apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads
_count"]=Module["asm"]["E"]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=M
odule["asm"]["F"]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"
]["G"]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"]["H"]).apply(
null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"]["J"]).apply(null,arguments
)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"]["K"]).apply(null,argumen
ts)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"]["L"]).apply(null,ar
guments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"]["M"]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"]["N"]).apply(null,argumen
ts)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]["O"]).ap
ply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]["P"]).a
pply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm"]["Q"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["R"]).apply(null,argument
s)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module[
"asm"]["S"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["T"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm"]["U"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["V"]).apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["W"]).apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize\"]=
Module["asm"]["X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["Y"]).a
pply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace\"]=M
odule["asm"]["Z"]).apply(null,arguments)};var

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_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=function(){return(_DeepwiseConv2dNative=Module["_DeepwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var

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_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"])[["wa
\n").apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"])[["x
a\n").apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"])[["ya\n").a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"])[["za\n").apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"])[["Aa\n").apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"])[["Ba\n").apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"])[["Ca\n").apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"])[["Da\n
\n").apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"])[["Ea\n").apl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"])[["Fa\n").apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"])[["Ga\n").apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"])[["Ha\n").apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"])[["Ia\n").apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"])[["Ja\n").app
ly(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"])[["Ka\n").apply(null,argum
ents)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"])[["La\n").apply(null,a
rguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"])[["Ma\n").apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"])[["Na\n").app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"])[["Oa\n").apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"])[["Pa\n").apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"])[["Qa\n").apply(null,arg
uments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"])[["Ra
\n").apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"])[["Sa\n").
apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"])[["Ta\n").ap
ply(null,arguments)};var

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_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).a
pply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,argume
nts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"$a"]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"cb"]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"db"]).apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"eb"]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"f
b"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"g
b"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][_"hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"ib"]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"jb"]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][_"kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][_"lb"]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["as
m"][_"mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"][_"nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][_"ob"]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]

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=function(){return(_emscripten_current_thread_process_queued_calls=Module[\"_emscripten_current_thread_proc
ess_queued_calls\"]=Module[\"asm\"][\"pb\"]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module[\"_emscripten_register_main_browser_thread_id\"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module[\"_emscripten_register_main_browser_thread_
id\"]=Module[\"asm\"][\"qb\"]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module[\"_emscripten_main_browser_thread_id\"]=function(){return(_ems
cripten_main_browser_thread_id=Module[\"_emscripten_main_browser_thread_id\"]=Module[\"asm\"][\"rb\"]).app
ly(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=function(){return(__ems
cripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=Module[\"asm\"][\"sb\"]).apply(n
ull,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=function(){retur
n(_emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=Module[\"asm\
\"][\"tb\"]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=function(
){return(_emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=
Module[\"asm\"][\"ub\"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module[\"__emscripten_call_on_thread\"]=function(){return(__emscripten_call_on_t
hread=Module[\"__emscripten_call_on_thread\"]=Module[\"asm\"][\"vb\"]).apply(null,arguments)};var
_emscripten_tls_init=Module[\"_emscripten_tls_init\"]=function(){return(_emscripten_tls_init=Module[\"_emscri
pten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Mod
ule[\"__emscripten_thread_init\"]=Module[\"asm\"][\"xb\"]).apply(null,arguments)};var
stackSave=Module[\"stackSave\"]=function(){return(stackSave=Module[\"stackSave\"]=Module[\"asm\"][\"yb\"]).a
pply(null,arguments)};var
stackRestore=Module[\"stackRestore\"]=function(){return(stackRestore=Module[\"stackRestore\"]=Module[\"asm\
\"][\"zb\"]).apply(null,arguments)};var
stackAlloc=Module[\"stackAlloc\"]=function(){return(stackAlloc=Module[\"stackAlloc\"]=Module[\"asm\"][\"Ab\
\"]).apply(null,arguments)};var
_emscripten_stack_set_limits=Module[\"_emscripten_stack_set_limits\"]=function(){return(_emscripten_stack_set_
limits=Module[\"_emscripten_stack_set_limits\"]=Module[\"asm\"][\"Bb\"]).apply(null,arguments)};var
_memalign=Module[\"_memalign\"]=function(){return(_memalign=Module[\"_memalign\"]=Module[\"asm\"][\"Cb
\"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module[\"__emscripten_allow_main_runtime_queued_calls\"]=1
0512;var
__emscripten_main_thread_futex=Module[\"__emscripten_main_thread_futex\"]=12148;Module[\"cwrap\"]=cwrap
;Module[\"PThread\"]=PThread;Module[\"PThread\"]=PThread;Module[\"wasmMemory\"]=wasmMemory;Module
[\"ExitStatus\"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name=\"ExitStatus\";this.message=\"Program terminated with
exit(\"+status+\")\";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({\"cmd\":\"loaded\"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[\"calledRun\"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\"onRuntimeInitialized\"])Module[\"onRuntimeInitialized\"]();postRun(
)}if(Module[\"setStatus\"])Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Mo
dule[\"setStatus\"](\"\"),1});doRun(),1)}else{doRun()}}Module[\"run\"]=run;function

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printErr!=="undefined"?printErr:print } else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("/")+1)}else{scriptDirectory=""}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ } var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} } moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function
ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]} } var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} } var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} } return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function

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stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;+i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\n"+what+\n). Build with -s ASSERTIONS=1 for more info.\n";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,\n";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://\n";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm\n";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new

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Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"}}return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile))}}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile))}}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\")addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscipten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscipten_get_heap_size(){return HEAPU8.length}function
emscipten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscipten_resize_heap(requestedSize){var oldSize=_emscipten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscipten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iocnt,pnum){var num=0;for(var
i=0;i<iocnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var

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j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return
0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case
155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case
74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return
2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return
2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return
1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return
20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var

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_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"]["z"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["A"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]["B"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["C"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]["D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["E"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["F"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]["Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]["R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"]["W"]).apply(null,arguments)};var

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_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_X]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_Y]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_Z]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_$]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_aa]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_ba]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_ca]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_da]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_ea]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_fa]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_ga]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_ha]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_ia]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_ja]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_ka]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_la]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_ma]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_na]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_oa]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_pa]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_qa]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_ra]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_sa]).apply(null,arguments)};var

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_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]["ta"]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]["ua"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"]["va"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]["wa"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"]["xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]["ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["Qa"]).apply(null,arguments)};var

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_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"])[\R
a")}.apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"])[\Sa")}.apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"])[\Ta")}.apply(nu
ll,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"])[\Ua")}.apply(null,argument
s)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"])[\Va")}.apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"])[\Wa")}.
apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][\Xa")}.apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"])[\Ya"
]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="\ExitStatus";this.message="\Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("\Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"]("\n"),1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]==="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n);};\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport
wasmFactoryThreadedSimd from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport
{wasmWorkerContents} from './wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory
from './wasm-out/tfjs-backend-wasm.js';\n\ninterface TensorData {\n id: number;\n memoryOffset: number;\n
shape: number[];\n dtype: DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded
bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-
primitive.\n\nexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private
dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:

```

```

BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
 this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:\n
 backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:\n
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n
numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):\n
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n
return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n
dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n
const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes,\n
shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n
const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n
 this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id,\n
size, memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n
(values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,\n
numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId):\n
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):\n
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =\n
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *\n
util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the\n
memory if the dataId\n
 has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force\n
Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if\n
(this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force\n
&& data.refCount > 0) {\n return false;\n }\n\n this.wasm._free(data.memoryOffset);\n
this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return\n
refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n
const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n
incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n
}\n }\n\n floatPrecision(): 32 {\n return 32;\n }\n\n
 // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId:\n
DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n
this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n\n
this.wasm = null;\n }\n\n memory() {\n return {unreliable: false};\n }\n\n /**\n * Make a tensor info for the\n
output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If\n
`memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer\n
where that memory lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n
TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape,\n
dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n
 this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n const size =\n
util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId,\n
shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray\n
{\n const buffer = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const\n
size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,\n
memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n
return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype\n
${dtype}`);\n }\n }\n\n function createInstantiateWasmFunc(path: string) {\n // this will be replace by rollout

```

```

plugin patchWechatWebAssembly in
 // miniprogram's output.
 // tslint:disable-next-line:no-any
 return (imports: any, callback: any) => {
 util.fetch(path, {credentials: 'same-origin'}).then((response) => {
 if (!response['ok']) {
 imports.env.a(`failed to load wasm binary file at '${path}'`);
 }
 response.arrayBuffer().then(binary => {
 WebAssembly.instantiate(binary, imports).then(output => {
 callback(output.instance, output.module);
 });
 });
 });
 return {};
 };

 /**
 * Returns the path of the WASM binary.
 * @param simdSupported whether SIMD is supported
 * @param threadsSupported whether multithreading is supported
 * @param wasmModuleFolder the directory containing the WASM binaries.
 */
 function getPathToWasmBinary(
 simdSupported: boolean, threadsSupported: boolean,
 wasmModuleFolder: string) {
 if (wasmPath != null) {
 // If wasmPath is defined, the user has supplied a full path to
 // the vanilla .wasm binary.
 return wasmPath;
 }

 let path:
 WasmBinaryName = 'tfjs-backend-wasm.wasm';
 if (simdSupported && threadsSupported) {
 path = 'tfjs-backend-wasm-threaded-simd.wasm';
 } else if (simdSupported) {
 path = 'tfjs-backend-wasm-simd.wasm';
 }

 if (wasmFileMap != null) {
 if (wasmFileMap[path] != null) {
 return wasmFileMap[path];
 }
 }

 return wasmModuleFolder + path;
 };

 /**
 * Initializes the wasm module and creates the js <--> wasm bridge.
 * NOTE: We wrap the wasm module in a object with property 'wasm' instead of
 * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested
 * in Chrome 76).
 */
 export async function init(): Promise<{wasm: BackendWasmModule}> {
 const [simdSupported, threadsSupported] = await Promise.all([
 env().getAsync('WASM_HAS_SIMD_SUPPORT'),
 env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')
]);

 return new Promise((resolve, reject) => {
 const factoryConfig: WasmFactoryConfig = {
 // This function overrides the Emscripten module locateFile utility.
 // @param path The relative path to the file that needs to be loaded.
 // @param prefix The path to the main JavaScript file's directory.
 locateFile = (path, prefix) => {
 if (path.endsWith('.worker.js')) {
 const response = wasmWorkerContents;
 const blob = new Blob([response], {type: 'application/javascript'});
 return URL.createObjectURL(blob);
 }
 if (path.endsWith('.wasm')) {
 return getPathToWasmBinary(
 simdSupported as boolean, threadsSupported as boolean,
 wasmPathPrefix != null ? wasmPathPrefix : prefix);
 }
 return prefix + path;
 };

 // Use the instantiateWasm override when system fetch is not available.
 // Reference: https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170
 if (customFetch) {
 factoryConfig.instantiateWasm = createInstantiateWasmFunc(
 getPathToWasmBinary(
 simdSupported as boolean, threadsSupported as boolean,
 wasmPathPrefix != null ? wasmPathPrefix :
));
 }

 let initialized = false;
 factoryConfig.onAbort = () => {
 if (initialized) {
 // Emscripten already called console.warn so no need to double log.
 return;
 }
 if (initAborted) {
 // Emscripten calls `onAbort` twice, resulting in double error
 // messages.
 return;
 }
 initAborted = true;
 const rejectMsg = `Make sure the server can serve the `.wasm` file relative to the ` +
 'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';
 reject({message: rejectMsg});
 };

 let wasm: Promise<BackendWasmModule>;

 // If `wasmPath` has been defined we must initialize the vanilla module.
 if (threadsSupported && simdSupported && wasmPath == null) {
 factoryConfig.mainScriptUrlOrBlob = new Blob(
 [var WasmBackendModuleThreadedSimd = ` +
 wasmFactoryThreadedSimd.toString()],
 {type: 'text/javascript'});
 wasm = wasmFactoryThreadedSimd(factoryConfig);
 } else {
 // The wasmFactory works for both vanilla and SIMD binaries.
 wasm = wasmFactory(factoryConfig);
 }

 // The WASM module has been successfully created by the factory.
 // Any error will be caught by the onAbort callback defined above.
 wasm.then((module) => {
 initialized = true;
 initAborted = false;
 const voidReturnType: string = null;

 // Using the tfjs namespace to avoid conflict with emscripten's API.
 module.tfjs = {
 init: module.cwrap('init', null, []),
 initWithThreadCount: module.cwrap('init_with_threads_count', null,

```

```

['number']),\n getThreadsCount:
 module.cwrap('get_threads_count', 'number', []),\n registerTensor: module.cwrap(\n 'register_tensor',
null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n dispose:
module.cwrap('dispose', voidReturnType, []),\n resolve({wasm: module});\n });\n });\n });\n\nfunction
typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype)
{\n case 'float32':\n return new Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const
;\n\ntype WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet
wasmPathPrefix: string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted =
false;\nlet customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the
`.wasm` file which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*/\n\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n
\n 'The WASM backend was already initialized. Make sure you call ' +\n `setWasmPath()` before you call
`tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch = usePlatformFetch;\n }\n\n/**\n
 * Configures the locations of the WASM binaries.\n * @param `js` setWasmPaths({\n * 'tfjs-backend-wasm.wasm':
'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n * 'tfjs-backend-wasm-threaded-
simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n * @param
prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory where the WASM
binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled,
threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n * full paths
specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located in the same
directory,
\n * or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional boolean to use
platform fetch to download\n * the wasm file, default to false.\n * @doc {heading: 'Environment', namespace:
'wasm'}\n */\n\nexport function setWasmPaths(\n prefixOrFileMap: string|{[key in WasmBinaryName]?: string},\n
usePlatformFetch = false): void {\n if (initAborted) {\n throw new Error(\n
\n 'The WASM backend was already initialized. Make sure you call ' +\n `setWasmPaths()` before you call `tf.setBackend()` or ' +\n
 `tf.ready()`);\n }\n\n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else
{\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name =>
wasmFileMap[name] == null);\n if (missingPaths.length > 0) {\n throw new Error(\n
\n `There were no entries found for the following binaries: ` +\n `${missingPaths.join(',')}`. Please either
call setWasmPaths with a ` +\n `map providing a path for each binary, or with a string indicating ` +\n
 `the directory where all the binaries can be found.`);\n }\n }\n\n customFetch = usePlatformFetch;\n }\n\n/**\n
 * Used in unit tests.\n */\n\nexport function resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n
wasmFileMap = {};\n customFetch = false;\n initAborted = false;\n }\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n * @param numThreads This must be called before calling
`tf.setBackend('wasm')`.\n */\n\nexport function setThreadsCount(numThreads: number) {\n threadsCount =
numThreads;\n }\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * @param It is set after the
backend is intialized.\n */\n\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n

```

```

throw new Error(`WASM
backend not initialized.`);
}
return actualThreadsCount;
}
export const wasmWorkerContents = `var
Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(
`);console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join(
`);postMessage({cmd:`alert`,text:text,threadId:Module[`_pthread_self`]()})}var
err=threadPrintErr;this.alert=threadAlert;Module[`instantiateWasm`]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module[`wasmModule`],info);Module[`wasmModule`]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===`load`){Module[`wasmModule`]=e.data.wa
smModule;Module[`wasmMemory`]=e.data.wasmMemory;Module[`buffer`]=Module[`wasmMemory`].buffer;
Module[`ENVIRONMENT_IS_PTHREAD`]=true;if(typeof
e.data.urlOrBlob===`string`){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd===`objectTransfer`){Module[`PThread`].receiveObjectTransfer(e.data)}else
if(e.data.cmd===`run`){Module[`__performance_now_clock_drift`]=performance.now()-
e.data.time;Module[`__emscripten_thread_init`](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[`establishStackSpace`](top,max);Module[`_emscripten_tls_init`](
);Module[`PThread`].receiveObjectTransfer(e.data);Module[`PThread`].setThreadStatus(Module[`_pthread_self
`](),1);try{var
result=Module[`invokeEntryPoint`](e.data.start_routine,e.data.arg);if(!Module[`getNoExitRuntime`]()
)Module[`PThread`].threadExit(result)}catch(ex){if(ex===`Canceled!`){Module[`PThread`].threadCancel()}else
if(ex!==`unwind`){if(ex instanceof
Module[`ExitStatus`]){if(Module[`getNoExitRuntime`]()
){}else{Module[`PThread`].threadExit(ex.status)}}el
se{Module[`PThread`].threadExit(-2);throw
ex}}}}else
if(e.data.cmd===`cancel`){if(Module[`_pthread_self`]()){Module[`PThread`].threadCancel()}else
if(e.data.target===`setimmediate`){}else
if(e.data.cmd===`processThreadQueue`){if(Module[`_pthread_self`]()){Module[`_emscripten_current_thread_
process_queued_calls`]()}}else{err(`worker.js received unknown command
`+e.data.cmd);err(e.data)}}catch(ex){err(`worker.js onmessage() captured an uncaught exception:
`+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===`object`&&typeof
process.versions===`object`&&typeof process.versions.node===`string`){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(`worker_threads`);global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(`message`,function(data){onmessage({data:data})});var
nodeFS=require(`fs`);var nodeRead=function(filename){return
nodeFS.readFileSync(filename,`utf8`)};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===`undefined`){performance={now:function(){return Date.now()}}};`/** @license See the
LICENSE file. */
This code is auto-generated, do not modify this file!
const version = `3.11.0`;
export
{version};
`/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
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Apache License, Version 2.0 (the `License`);
 * you may not use this file except in compliance with the
License.
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on an `AS IS` BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,

```

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```
=====\n\n*\n\nimport './flags_wasm';\nimport {registerBackend} from '@tensorflow/tfjs-core';\nimport {BackendWasm,\ninit} from './backend_wasm';\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,\nsetWasmPaths} from './backend_wasm';\nexport {version as version_wasm} from './version';\nconst\nWASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new\nBackendWasm(wasm);\n},\nWASM_PRIORITY);\n], "names": ["CppType", "FusableActivation", "wasmFusedMatMul", "fusedMatMulConfig",\n, "kernelName", "_FusedMatMul", "backendName", "setupFunc", "backend", "wasm", "cwrap", "kernelFunc", "args", "inp\nuts", "attrs", "a", "b", "bias", "preluActivationWeights", "dtype", "Error", "transposeA", "transposeB", "activation", "leakyR\neluAlpha", "aId", "dataIdMap", "get", "dataId", "id", "bId", "biasId", "biasData", "shape", "length", "preluActivationWeight\nsId", "fusedActivation", "leftDim", "rightDim", "batchDim", "out", "makeOutput", "outId", "aShapeBytes", "Uint8Array",\n"Int32Array", "buffer", "bShapeBytes", "createUnaryKernelConfig", "outType", "wasmFunc", "x", "xId", "util", "sizeFrom\nShape", "absConfig", "Abs", "createBinaryKernelConfig", "supportsFullBroadcast", "outputType", "newShape", "back\nend_util", "assertAndGetBroadcastShape", "aBroadcastDims", "getBroadcastDims", "bBroadcastDims", "loopsOverAll\nOfA", "every", "v", "i", "loopsOverAllOfB", "addConfig", "Add", "addNConfig", "AddN", "inputIds", "map", "inputIdsByt\nes", "identity", "inVals", "typedArrayFromHeap", "set", "identityConfig", "Identity", "wasmTranspose", "transpose", "red\nucedShape", "perm", "newPerm", "push", "minValIdx", "j", "removeOneSizeDims", "permIsNoOp", "outShape", "inShap\n", "Array", "computeOutShape", "cloned", "permBytes", "xShapeBytes", "transposeConfig", "Transpose", "permuteAxe\nsAndTranspose", "axis", "xShape", "xRank", "originalAxes", "parseAxisParam", "axes", "permutedAxes", "getAxesPerm\nutation", "xTransposed", "inputWasTransposed", "getInnerMostAxes", "transposed", "wasmAll", "allConfig", "All", "kee\npDims", "inputId", "input", "inputRank", "assertAxesAreInnerMostDims", "reduceShape", "computeOutAndReduceSha\npes", "reduceSize", "disposeData", "expandShapeToKeepDim", "wasmAny", "anyConfig", "Any", "argMaxConfig", "Ar\n", "gMax", "transposedId", "slice", "outerSize", "innerSize", "wasmAvgPool", "avgPoolConfig", "AvgPool", "filterSize", "str\nides", "pad", "dimRoundingMode", "convInfo", "computePool2DInfo", "filterHeight", "filterWidth", "padTop", "padInfo\n", "top", "padRight", "right", "padBottom", "bottom", "padLeft", "left", "strideHeight", "strideWidth", "channels", "inChan\nnels", "dataFormat", "dilationWidth", "dilationHeight", "reshape", "xSize", "$shape", "inferFromImplicitShape", "assert",\n"incRef", "reshapeConfig", "Reshape", "wasmBatchMatMul", "batchMatMulConfig", "BatchMatMul", "aRank", "bRank\n", "innerShapeA", "innerShapeB", "outerShapeA", "outerShapeB", "outerDimsA", "outerDimsB", "batchDimA", "batchD\nimB", "batchDimsCompatible", "concat", "b3dShape", "a3d", "b3d", "a3dId", "b3dId", "Math", "max", "sliceImpl", "vals", "\nbegin", "size", "isContinous", "slice_util", "isSliceContinous", "xStrides", "computeStrides", "flatOffset", "computeFlatO\nffset", "subarray", "decodedData", "fromUint8ToStringArray", "inBuf", "outBuf", "outLoc", "indexToLoc", "inLoc", "idx\n", "fromStringArrayToUint8", "values", "begin_", "size_", "parseSliceParams", "xVals", "readSync", "outData", "stringBy\n", "res", "sliceImplCPU", "outVals", "rank", "xStride", "outOffset", "beginI", "beginJ", "endI", "xOffset", "slice2d", "xStr\n", "ide1", "xStride2", "beginK", "endJ", "slice3d", "xStride3", "endK", "beginL", "k", "slice4d", "sliceConfig", "Slice", "batchT\n", "oSpaceNDConfig", "BatchToSpaceND", "blockShape", "crops", "prod", "reduce", "reshaped", "getReshaped", "permuted\n", "getPermuted", "reshapedPermuted", "getReshapedPermuted", "sliceBeginCoords", "getSliceBeginCoords", "sliceSiz\n", "e", "getSliceSize", "xReshaped", "result", "cast", "castConfig", "Cast", "ceilConfig", "Ceil", "wasmClip", "clipByValueCo\n", "nfig", "ClipByValue", "clipValueMin", "clipValueMax", "t", "$inputs", "filter", "shapes", "assertParamsConsistent", "inp\n", "uts2D", "inputsValShapes", "simplyConcat", "getArrayFromDType", "offset", "forEach", "colOffset", "tIdx", "row", "resI\n", "dx", "col", "concatImplCPU", "finalOutShape", "sumInnerDims", "innerDims", "innerDim", "inOffset", "concatConfig", "\n", "Concat", "wasmConv2d", "conv2DConfig", "Conv2D", "filterId", "dilations", "$dataFormat", "convertConv2DDataFor\n", "mat", "computeConv2DInfo", "inputChannels", "outputChannels", "outChannels", "isSamePad", "type", "wasmConv2D\n", "BackpropInput", "conv2DBackpropInputConfig", "Conv2DBackpropInput", "dy", "inputShape", "batchSize", "inHeight\n", "inWidth", "outHeight", "outWidth", "topPad", "leftPad", "isChannelsLast", "dxStrides", "dyStrides", "fltS0", "fltS1", "fl\n", "tS2", "xBatchStride", "xRowStride", "xColStride", "xChannelStride", "yBatchStride", "yRowStride", "yColStride", "yCh\n", "annelStride", "dyId", "cosConfig", "Cos", "coshConfig", "Cosh", "InterpolationMethod", "wasmCropAndResize", "cropA
```



ndResizeConfig", "CropAndResize", "method", "extrapolationValue", "cropSize", "image", "boxes", "boxInd", "numBoxes", "cropHeight", "cropWidth", "castedData", "imagesData", "imagesId", "boxesId", "boxIndId", "imagesShapeBytes", "wasmCumsum", "cumsumConfig", "Cumsum", "exclusive", "reverse", "permutation", "permutedX", "permutedAxis", "permutedOut", "finalDim", "permutedXId", "permutedOutId", "getUndoAxesPermutation", "wasmDepthToSpace", "depthToSpaceConfig", "DepthToSpace", "blockSize", "outputHeight", "outputWidth", "outputDepth", "outputShape", "xStridesBytes", "outputShapeBytes", "outStridesBytes", "wasmDepthwiseConv2d", "depthwiseConv2dNativeConfig", "DepthwiseConv2dNative", "\$dilations", "eluConfig", "Elu", "equalConfig", "Equal", "expConfig", "Exp", "expandDims", "dim", "\$dim", "splice", "expandDimsConfig", "ExpandDims", "fill", "value", "fillConfig", "Fill", "wasmFlipLeftRight", "flipLeftRightConfig", "FlipLeftRight", "imageId", "batch", "imageHeight", "imageWidth", "numChannels", "floorConfig", "Floor", "floorDivConfig", "FloorDiv", "wasmBatchNorm", "fusedBatchNormConfig", "FusedBatchNorm", "varianceEpsilon", "mean", "variance", "scale", "meanId", "varianceId", "offsetId", "scaleId", "wasmFusedConv2d", "fusedConv2DConfig", "FusedConv2D", "wasmFusedDepthwiseConv2d", "fusedDepthwiseConv2DConfig", "FusedDepthwiseConv2D", "wasmGatherNd", "gatherNdConfig", "GatherNd", "params", "indices", "resultShape", "numSlices", "gather\_util", "prepareAndValidate", "indicesShape", "sliceRank", "indicesId", "stridesBytes", "wasmGather", "gatherV2Config", "GatherV2", "batchDims", "parsedAxis", "indicesVals", "axisDim", "index", "shapeInfo", "segment\_util", "collectGatherOpShapeInfo", "flattenX", "dimSize", "indicesSize", "flattenIndex", "flattenOutputShape", "stridesSize", "greaterConfig", "Greater", "greaterEqualConfig", "GreaterEqual", "leakyReluConfig", "LeakyRelu", "alpha", "lessConfig", "Less", "lessEqualConfig", "LessEqual", "logConfig", "Log", "logicalAndConfig", "LogicalAnd", "wasmMax", "maxConfig", "Max", "reductionIndices", "maximumConfig", "Maximum", "wasmMaxPool", "maxPoolConfig", "MaxPool", "wasmMean", "meanConfig", "Mean", "reductionAxes", "castedInput", "wasmMin", "minConfig", "Min", "minimumConfig", "Minimum", "MirrorPaddingMode", "wasmMirrorPad", "mirrorPadConfig", "MirrorPad", "paddings", "mode", "p", "prePaddingsFlat", "padTuple", "postPaddingsFlat", "prePaddingsBytes", "postPaddingsBytes", "multiplyConfig", "Multiply", "negConfig", "Neg", "parseResultStruct", "resOffset", "HEAPU8", "pSelectedIndices", "selectedSize", "pSelectedScores", "pValidOutputs", "\_free", "nonMaxSuppressionV3Config", "NonMaxSuppressionV3", "iouThreshold", "maxOutputSize", "scoreThreshold", "scores", "scoresId", "nonMaxSuppressionV4Config", "NonMaxSuppressionV4", "padToMaxOutputSize", "nonMaxSuppressionV5Config", "NonMaxSuppressionV5", "softNmsSigma", "notEqualConfig", "NotEqual", "wasmOneHot", "oneHotConfig", "OneHot", "depth", "onValue", "offValue", "onesLikeConfig", "OnesLike", "packConfig", "Pack", "assertShapesMatch", "intermediateTensorInfos", "expandedT", "wasmPadV2", "padV2Config", "PadV2", "constantValue", "powConfig", "Pow", "wasmPrelu", "preluConfig", "Prelu", "weightsId", "wasmProd", "prodConfig", "Prod", "rangeConfig", "Range", "start", "stop", "step", "makeZerosTypedArray", "numElements", "abs", "ceil", "rangeImplCPU", "realDivConfig", "RealDiv", "reluConfig", "Relu", "relu6Config", "Relu6", "wasmResizeBilinear", "resizeBilinearConfig", "ResizeBilinear", "images", "alignCorners", "halfPixelCenters", "newHeight", "newWidth", "oldHeight", "oldWidth", "xData", "wasmReverse", "reverseConfig", "Reverse", "dims", "axesBytes", "outShapeBytes", "wasmRotate", "rotateWithOffsetConfig", "RotateWithOffset", "radians", "fillValue", "center", "centerX", "centerY", "getImageCenter", "fillValues", "fillBytes", "roundConfig", "Round", "rsqrtConfig", "Rsqrt", "wasmScatterNd", "scatterNdConfig", "ScatterNd", "updates", "numUpdates", "outputSize", "scatter\_util", "calculateShapes", "updatesId", "wasmSelect", "selectConfig", "Select", "condition", "e", "conditionId", "tId", "eId", "cRank", "tRank", "sigmoidConfig", "Sigmoid", "sinConfig", "Sin", "softmaxConfig", "Softmax", "logits", "spaceToBatchNDConfig", "SpaceToBatchND", "completePaddings", "paddedX", "reshapedPaddedShape", "permutedReshapedPaddedPermutation", "flattenShape", "paddedXReshaped", "paddedXT", "splitVConfig", "SplitV", "numOrSizeSplits", "\$axis", "splitSizes", "prepareSplitSize", "s", "xSliceSize", "xSlice", "sqrtConfig", "Sqrt", "squareConfig", "Square", "squaredDifferenceConfig", "SquaredDifference", "wasmStep", "stepConfig", "Step", "wasmStridedSlice", "stridedSliceConfig", "StridedSlice", "end", "beginMask", "endMask", "ellipsisMask", "newAxisMask", "shrinkAxisMask", "finalShapeSparse", "finalShape", "isIdentity", "sliceDim0", "isSimpleSlice", "\$begin", "\$end", "\$strides", "sliceInfo", "sliced", "beginBytes", "endBytes", "subConfig", "Sub", "wasmSum", "sumConfig", "Sum", "tanConfig", "Tan", "tanhConfig", "Tanh", "wasmTile", "wasmTopK", "wasmTransform", "kernelConfigs", "Tile", "reps", "newShapeBytes", "TopK", "sorted", "outValues", "outValuesId", "outIndices", "outIndicesId", "Transform", "transforms", "interpolation", "fillMode", "transformsId", "interpolationModeId", "fillModeId", "Unpack", "numOutputs", "outIndex", "outs", "ZerosLike", "kernelConfig", "registerKernel", "ENV", "env", "registerFlag", "async", "WebAssembly", "validate", "MessageChan

nel", "port1", "postMessage", "SharedArrayBuffer", "\_scriptDir", "WasmBackendModuleThreadedSimd", "document", "currentScript", "src", "undefined", "\_\_filename", "GROWABLE\_HEAP\_I8", "wasmMemory", "updateGlobalBufferAndViews", "HEAP8", "GROWABLE\_HEAP\_U8", "GROWABLE\_HEAP\_I32", "HEAP32", "GROWABLE\_HEAP\_U32", "HEAPU32", "GROWABLE\_HEAP\_F64", "HEAPF64", "readyPromiseResolve", "readyPromiseReject", "Module", "Promise", "resolve", "reject", "key", "moduleOverrides", "hasOwnProperty", "quit\_", "status", "toThrow", "ENVIRONMENT\_IS\_WEB", "ENVIRONMENT\_IS\_WORKER", "ENVIRONMENT\_IS\_NODE", "ENVIRONMENT\_IS\_SHELL", "window", "importScripts", "process", "versions", "node", "ENVIRONMENT\_IS\_PTHREAD", "read\_", "readAsync", "readBinary", "nodeFS", "nodePath", "scriptDirectory", "locateFile", "path", "nodeWorkerThreads", "require\$\$0", "dirname", "\_\_dirname", "filename", "binary", "require\$\$1", "ret", "replace", "ex", "ExitStatus", "abort", "require\$\$2", "console", "error", "global", "Worker", "read", "f", "data", "readbuffer", "scriptArgs", "quit", "print", "log", "warn", "printErr", "self", "location", "href", "indexOf", "substr", "lastIndexOf", "url", "xhr", "XMLHttpRequest", "open", "send", "responseText", "responseType", "response", "onload", "onerror", "performance", "require\$\$3", "wasmBinary", "bind", "err", "warnOnce", "text", "shown", "wasmModule", "noExitRuntime", "ABORT", "getCFunc", "ident", "func", "ccall", "returnType", "argTypes", "opts", "toC", "string", "str", "len", "stringToUTF8", "stackAlloc", "array", "arr", "writeArrayToMemory", "cArgs", "stack", "converter", "stackSave", "apply", "UTF8ToString", "Boolean", "convertReturnValue", "stackRestore", "numericArgs", "arguments", "UTF8ArrayToString", "heap", "maxBytesToRead", "endIdx", "u0", "u1", "u2", "String", "fromCharCode", "ch", "ptr", "stringToUTF8Array", "outIdx", "maxBytesToWrite", "startIdx", "u", "charCodeAt", "outPtr", "lengthBytesUTF8", "alignUp", "multiple", "buf", 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C,EA AKC,cAAcihB,EAAOtiB,OAC5B,OAAOO,EAET,MAAME,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAUhD,OARAUib,GAClhb,EA AKsW,EAAOkL,EAAWC,EAAUhL,EAAa6K,EAAWC,EACzDH,EA Ae,EA AI,EAAGC,EA AmB,EA AI,EAAG/hB,GAEIC,MAAd0T,GACF5V,EAAQuH,YAAYqO,EAAWxU,QAG1BY,I CxDT,IAAIuib,GA6CG,MAAMC,GAA8B,CACzC5kB,WAA Y6kB,GACZ3kB,YAAa,OACbK,oBAhCEC,GA EF,MAAMC,OAACA,EAAML,QAAEA,EAAOM,MAAEA,GAASF,GAC3BuC,EAACA,GA AKtC,GACNqkB,KAA CA,GAAQpkB,EAET+F,EAAOxD,EA AKuD,eAAese,EAAM/hB,EAAEIB,OAEzC,GAAuB,IAAnBkB,EAAEIB,MAAMC,OACV,OAAO4C,GAAS,CAACjE,OAAQ,CAACsC,EAAAA,GAAI3C,QAAAA,IAGhC,MAAMgC,EA AMhC,EAAQIC,WAAWU,EAAEIB,MAAOkB,EAAEhC,OACpCic,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAA EvB,QAAQC,GACtCa,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GA E1CsjB,EAAY,IAAIviB,WAAW,IAAIC,WAAWgE,GAAM/D,QACHdsiB,EAAGb,IAAIxiB,WAAW,IAAIC,WAAWM,EAAEIB,OAAOa,QA E7Dii B,GACI3hB,EA AK+hB,EA AWte,EA AK3E,OAAQkjB,EA AEjiB,EAAEIB,MAAMC,OAAQQ,GA EhE,MAAMmN ,EACFxF,GAAQ,CAACxJ,OAAQ,CAACsC,EAAGX,GAAM1B,MAAO,CAACmB,MAAOkB,EAAEIB,OAAQzB ,QAAAA,IAGxD,OADAA,EAAQuH,YAAYvF,EAAIZ,QACjBiO,GAOPtP,UA7CF,SAAeC,GACbukB,GA AcvKB ,EAAQC,KAAKC,MAAMukB,GAAS,KAAM,CAC9C,SACA,QACA,SACA,QACA,SACA,aCbJ,IAAII,GAqDG, MAAMC,GAAuC,CACIDiB,WAA YmlB,GACZjB,YAAa,OACbK,oBAnC+BC,GAK/B,MAAMC,OAACA,EA AML,QAAEA,EAAOM,MAAEA,GAASF,GAC3BkV,MAACA,GAASjV,GACV2kB,QAACA,EAAOC,UAAEA,E AASC,OAAEA,GAAU5kB,EAE/B0B,EAAMhC,EAAQIC,WAAWqT,EAAM7T,MAAO6T,EAAM3U,OAC5CsY, EAAUjZ,EAAQkB,UAAUC,IAAIuU,EAAMIU,QAAQC,GAC9Ca,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,Q AAQC,IAEzC6X,EAAOC,EAAaC,EAAYC,GAAe/D,EAAM7T,OA ErD0jB,EAASC,GACZ/hB,EA AagiB,eAAeH, EAAQ/L,EAAaC,GAK/CkM,EA AKC,iBAAdL,EACtB,CAACA,EA AWA,EA AWA,EAJO,IAAdA,EA IgC,EAH3B, KA IrB,IAAIA,EA JiB,KAKnBM,EAAY,IAAIInjB,WAAW,IAAIC,WAAWijB,GAAYhjB,QAK5D,OAHAuiB,GAC I5L,EAASC,EAAOC,EAAaC,EAAYC,EAAa2L,EAASG,EAC/DC,EAASG,EA AWD,EA AW5jB,OAAQQ,GACpC F,GAOPjC,UApDF,SAAeC,GACb6kB,GAAa7kB,EAAQC,KAAKC,MAAM6kB,GA AkB,KAAiB,CACjE,SACA, SACA,SACA,SACA,SACA,SACA,SACA,SACA,QACA,SACA,aCnBSS,GAA4BhjB,GA AwBijB,ICDpDC,GAA4 BljB,GA AwBmjB,ICIjE,IAAIC,GAmDG,MAAMC,GAAgC,CAC3CjmB,WAA YkmB,GACZhmB,YAAa,OACbC, UAjDF,SAAeC,GACb4IB,GAAgB5IB,EAAQC,KAAKC,MAAM4IB,GAAW,KAAe,CAC3D,SACA,SACA,SACA ,SACA,SACA,SACA,QACA,SACA,YAwCF3IB,WApCF,SACIC,GAGF,MAAMJ,QAACA,EAAOK,OAAEA,EA AMC,MAAEA,GAASF,GAC3B2a,QAACA,EAAOgL,QAAEA,GA AW1IB,GACrBoB,MAACA,GAASnB,EA EV0 B,EAAMhC,EAAQIC,WAAWR,EAAOsK,EAAQpIB,OAC9C,GA AKC,IAA9BkC,EA AKC,cAAcrB,GACrB,OA AOO,EAGT,MAAMqZ,UACA,EAAS2K,WAAEA,EAAUnW,UAAEA,EAASvH,QAAEA,EAAO2d,WAAEA,G AC9CC,GAAaC,gBAAGBJ,EAAShL,EAAStZ,GAG7C6Z,EADctb,EAAQkB,UAAUC,IAAI4Z,EAAQ3Z,QACpB C,GAGxB+kB,EADcpmB,EAAQkB,UAAUC,IAAI4kB,EAAQ3kB,QACpBC,GA ExBka,EAAe,IAAIInZ,WAAW,IA AIC,WAAWiG,GAAShG,QA EtDJ,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAKhD,OAJAukB,GA CItK,EAAW8K,EAAW5mB,GAASumB,EAAQpIB,OAAQ0a,EAAW2K,EAC1DnW,EAAW0L,EAAc0K,EAAY/j B,GA EICF,ICIDT,IAAIqkB,GAmCG,MAAMC,GAA6B,CACxC1mB,WAA Y2mB,GACZzmB,YAAa,OACbK,W AxBF,SAAGBC,GACd,MAAMC,OAACA,EAAML,QAAEA,GA AWI,GACpBomB,UACA,EAAS7V,EAAEA,E AAC8V,EAAEA,GA AKpmB,EA EpBqmB,EA Ac1mB,EAAQkB,UAAUC,IAAIqIB,EAAUpIB,QAAQC,GACtDsl B,EAAM3mB,EAAQkB,UAAUC,IAAIwP,EA AEvP,QAAQC,GACtCulB,EAAM5mB,EAAQkB,UAAUC,IAAIsl B,EA AErlB,QAAQC,GACtCW,EAAMhC,EAAQIC,WAAW0O,EAAEIP,MAAOkP,EA AEhQ,OACpCuB,EAAQI C,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GA E1CwIB,EAAQL,EAAU/kB,MAAMC,OACxBolB,EAAQnW,E AAEIP,MAAMC,OA EhB0P,EA AmB,IAAVyV,GAAeA,EAAQ,GAAe,IAAVC,EACvC,EACAjkB,EA AKC,cAAc6 N,EA AEIP,MAAMsG,MAAM,IAGrC,OADase,GA AWK,EAAaC,EA AKC,EA AKxV,EAAQIP,GACnCF,GAOPj C,UAnCF,SAAeC,GACbqmB,GAAarmB,EAAQC,KAAKC,MAAM,WAA Y,KAAAM,CACHD,SACA,SACA,SAC A,SACA,aCVJ,IAAIwC,GAsBG,MAAMqkB,GAA8B,CACzCnnB,WAA Y,UACZE,YAAa,OACbC,UAvBF,SAAe C,GACb0C,GA AW1C,EAAQC,KAAKC,MAAM8mB,GAAS,KAAiB,CAAC,SAAU,YAuBnE7mB,WApBF,SA Ai BC,GA Ef,MAAMJ,QAACA,EAASK,QAAQsC,EAACA,IAAMvC,EACzBwC,EAAM5C,EAAQkB,UAAUC,IAAI wB,EA AEvB,QAAQC,GACtCW,EAAMhC,EAAQIC,WAAWU,EAAEIB,MAAOkB,EA AEhC,OACpCuB,EAAQI C,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAGhD,OAAcS,IAAICwB,EA AKC,cAAcd,EA AIP,QAI3BiB,GAA

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I,GAAG,EAAE,IAAIC,EAAQ5J,GAAQ6J,SAASF,GAAaC,EAAQE,OAAOC,YAAAY/J,GAAQgK,eAAeJ,GAAS5J ,GAAQiK,eAAehsB,OAAO+hB,GAAQiK,eAAerS,QAAQgS,EAAQE,QAAQ,GAAGF,EAAQE,OAAOF,aAAQz W,EAAU,SAAS+W,GAAaP,GAAa,GAAgtU,EAAuB,KAAK,uFAAuF,IAAIsU,EAAY,KAAK,oDAAgE3J,GAA Q6J,SAASF,GAAqBG,OAAOIX,YAAAY,CAACuX,IAAM,WAAW,SAASC,GAACt,GAAa,GAAgtU,EAAuB,KA AK,wFAAwF,IAAIsU,EAAY,KAAK,qDAAqD,IAAIC,EAAQ5J,GAAQ6J,SAASF,GAAa,GAAGC,EAAQ,CAACI W,IAAoBiW,EAAY,IAAI,GAAG,EAAE,IAAIG,EAAOF,EAAQE,OAAO9J,GAAQqK,mBAAmBP,IAArsC5V,E AA+B,uBAAE6U,GAA6qC,IAA0xMuB,GAAtxMtK,GAAQ,CAACC,cAAc,GAAGgK,eAAe,GAAGM,oBAAoB, WAAiC,IAAtB,IAA8BhhC,EAAE,EAAEA,EAAd,IAAkCA,EAAGy2B,GAAQwK,wBAAyB9M,YAAAY,WAA+B, IAApB,IAAI+M,EAAGC,GAAQ,KAAanhC,EAAE,EAAEA,EAAE,KAAQA,EAAEqqB,IAAoB6W,EAAG,EAAE lhC,GAAG,EAAEmqB,IAAoB+W,EAAG,IAAI,GAAGA,EAAG,IAAIE,EAAQF,EAAG,IAAI/W,IAAoBiX,GAAS ,GAAGA,EAAQ,IAAIC,EAAUF,GAAQ,KAAK,IAAQnhC,EAAE,EAAEA,EAAE,MAAMA,EAAEqqB,IAAoBg X,EAAU,EAAErhC,GAAG,EAAE6/B,QAAQyB,MAAMjX,IAAoB6W,EAAG,KAAK,EAAEG,GAAWxB,QAAQ yB,MAAMjX,IAAoB6W,EAAG,IAAI,EAAEA,GAAIK,GAAyBL,GAAI5V,EAAsB,GAAGkW,GAA4CN,IAAKO ,WAAW,aAAanB,SAAS,GAAGoB,mBAAmB,GAAGC,gBAAgB,aAAaC,gBAAgB,WAAW,KAAmNl,GAAQiL, mBAAmB7jC,OAAO,GAAG44B,GAAQiL,mBAAmBG,KAA3BpL,GAAsC3K,GAAWBgW,MAAgBC,MAA4BC, +BAA+B,SAASd,EAAGe,GAAUpC,QAAQyB,MAAMjX,IAAoB6W,EAAG,IAAI,EAAE,GAAGrB,QAAQyB,M AAMjX,IAAoB6W,EAAG,IAAI,EAAE,GAAGzK,GAAQmL,kBAAkB/B,QAAQyB,MAAMjX,IAAoB6W,EAAG, GAAG,EAAEe,GAAUpC,QAAQyB,MAAMjX,IAAoB6W,EAAG,GAAG,EAAE,GAAG1B,GAAuB0B,EAAG,EA AE,YAAAYK,GAAyB,EAAE,EAAE,IAAIW,WAAW,SAASD,GAAU,IAAIIf,EAAGY,KAAmBZ,IAAIzK,GAAQu L,+BAA+Bd,EAAGe,GAAanW,GAAwBzC,YAAAY,CAACuX,IAAM,WAAyU,uBAAa,WAAW1L,GAAQuL,+BA A+BF,MAAiB,GAAGzY,YAAAY,CAACuX,IAAM,gBAAgBwB,oBAAoB,WAAW,IAAI,IAAI1B,KAAK2pB,GA AQ6J,UAAcD,EAAQ5J,GAAQ6J,SAASzxB,KAAeuzB,EAAQE,QAAQ9J,GAAQqK,mBAAmBT,EAAQE,QAAS 9J,GAAQ6J,SAAS,GAAG,IAAI,IAAItgC,EAAE,EAAEA,EAAEy2B,GAAQC,cAAc74B,SAASmC,GAAOugC,E AAO9J,GAAQC,cAAc12B,IAAUwgC,YAAqC,IAAzB/J,GAAQC,cAAc,GAAW12B,EAAE,EAAEA,EAAEy2B,G AAQiK,eAAe7iC,SAASmC,EAAE,CAAC,IAAIugC,EAAqCF,GAARCE,EAAO9J,GAAQiK,eAAe1gC,IAAsBqgC, QAAQ5J,GAAQgK,eAAeJ,GAASE,EAAOC,YAAAY/J,GAAQiK,eAAe,IAAID,eAAe,SAASJ,GAAS,GAAlA,EAA J,CAAmB,GAAGA,EAAQgC,iBAAiB,CAAC,IAAIhB,EAAUIX,IAAoBkW,EAAQgC,iBAAiB,KAAK,GAAGIY,I AAOBkW,EAAQgC,iBAAiB,KAAK,GAAG,EAAEhmB,GAAMglB,GAAWhlB,GAAMgkB,EAAQgC,kBAAkBh C,EAAQgC,iBAAiB,EAAKhC,EAAQiC,mBAAmBjC,EAAQkC,WAAUlmB,GAAMgkB,EAAQkC,WAAWIC,EA AQkC,UAAU,EAAKIC,EAAQE,SAAOF,EAAQE,OAAOF,QAAQ,QAAMS,mBAAmB,SAASP,GAAQ9J,GAAQ +L,iCAAgC,kBAAkB/L,GAAQ6J,SAASC,EAAOF,QAAQgC,kBAAkB5L,GAAQC,cAAc1B,KAAKm/B,GAAQ9 J,GAAQiK,eAAehsB,OAAO+hB,GAAQiK,eAAerS,QAAQks,GAAQ,GAAG9J,GAAQgK,eAAeF,EAAOF,SAAS E,EAAOF,aAAQzW,MAAa4Y,gCAAgC,SAASzS,GAAM5F,IAAoBsY,IAA8C,GAAG,EAAE,IAAIIS,IAAO,QA AQ5F,IAAoBsY,IAA8C,GAAG,IAAIC,sBAAsB,SAAShV,KAAQkJ,uBAAuB,SAAS2J,EAAOoC,GAAMBpC,EA AOqC,UAAU,SAAShgB,GAAG,IAAIigB,EAAEjgB,EAAQ,KAAmge,EAAIiC,EAAO,IAAGg,GAA3FtC,EAAOF ,UAAQ5J,GAAQqM,oCAAoCvC,EAAOF,QAAQgC,kBAAoBQ,EAAgB,cAAGA,EAAgB,cAAGf,KAAgB,CAAC ,IAAIiB,EAAOtM,GAAQ6J,SAASuC,EAAEG,cAAoR,OAAAnQD,EAAQA,EAAOxC,OAAOIX,YAAAYzG,EAAE8 K,KAAKmV,EAAGB,cAAQzV,QAAQC,MAAM,0CAA0CuT,EAAI,uBAAuBiC,EAAGB,aAAE,4CAAuCpM,GA AQqM,yCAAoCIZ,GAAiB,GAAS,gCAANgX,EAAqCqC,UAAoD,GAAS,gBAANrC,EAAqBsC,GAAYtgB,EAAE 8K,WAAW,GAAS,kBAANKT,EAAuBC,GAAGcG,EAAU,aAAQ,GAAS,eAANjC,EAAoBT,GAAW0C,EAAU,aA AQ,GAAS,iBAANjC,EAAsBD,GAAakC,EAAU,aAAQ,GAAS,WAANjC,EAAGBL,EAAO4C,QAAO,EAAQR,GA AkBA,EAakBpC,GAAWA,EAAO6C,aAAY7C,EAAO6C,oBAAoB7C,EAAO6C,iBAAiB,GAAS,UAAANxC,EAAe ziC,EAAI,UAAU0kC,EAAY,SAAE,KAAKA,EAAQ,WAAQ,GAAS,aAANjC,EAakBtR,EAAI,UAAUuT,EAAY, SAAE,KAAKA,EAAQ,WAAQ,GAAS,UAAANjC,EAAeyC,MAAM,UAAUR,EAAY,SAAE,KAAKA,EAAQ,WAA Q,GAAS,SAANjC,EAA2BL,EAAOF,SAASR,QAAQC,KAAKzV,IAAoBkW,EAAOF,QAAQgC,iBAAiB,IAAI,IA AgB5L,GAAQqK,mBAAmBP,QAAc,GAAS,gBAANK,EAAqB,IAAI0C,GAAKT,EAAc,YAAG,MAAMjgB,GAAG,GAAGA,aAAaqK,GAAW,OAAO,MAAMrK,MAAiB,eAANge,EAAoBnK,GAAQqK,mBAAmBP,GAASB,mB AANK,EAAwBnK,GAAQiM,sBAAsB9f,EAAE8K,MAA8B,iBAAhB9K,EAAE8K,KAAK6V,OAAyBhD,EAAOI



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Alk3B,IAAqB/J,EAA+B,wBAAGA,EAA+B,uBAAE+J,GAakB,SAASG,EAAoBr3B,GAA6G,GAAzGk3B,IAAqB /J,EAA+B,wBAAGA,EAA+B,uBAAE+J,GAaQc,GAajBA,GAaQHC,EAAsB,CAAC,IAAIG,EAASH,EAAsBA,E AAsB,KAAKG,KAAuE,SAAS5H,GAAM6H,GAASpK,EAAGB,SAAGA,EAAGB,QAAEoK,GAAezF,EAATyF,G AAM,IAAanF,GAAM,EAakBmF,EAak,SAASA,EAak,+CAA+C,IAAIInS,EAAE,IAAIqG,YAAY+L,aAAaD,G AA4B,MAAtBrK,EAAMb9H,GAASA,EAAE,SAASqS,GAAU3E,EAAI4E,GAAQ,OAAOnD,OAAOoD,UAAUC, WAAW9E,EAAI8E,WAAWF,GAA8B,IAAtB5E,EAaijC,QAAQ6G,GAAZvK,EAawB,gBAAE,GAAGA,EAaw B,gBAAE,GAA2W,IAAI0K,GAac,wCAAwC,SAASC,GAAU3I,GAAU,OAAOsI,GAAUti,EAAS0I,IAAe,IAAIE, GAac,UAAU,SAASC,GAAU7I,GAAU,OAAOsI,GAAUti,EAAS4I,IAAe,IAAIE,GAae,yBAakG,SAASC,GAAU C,GAAM,IAAI,GAAGA,GAAMF,IAAGBrG,EAAY,OAAO,IAAI7wB,WAAW6wB,GAAY,GAAGnD,EAAY,OA AOA,EAAW0J,GAAW,KAAK,kDAAMd,MAAMrG,GAAKpC,GAAMoC,IAAM,SAASsG,KAAmB,IAAIxG,IA Aa/D,GAAoBC,GAAuB,CAAC,GAakB,mBAARuK,QAAqBL,GAAUC,IAAiB,OAAOI,MAAMJ,GAae,CAACK ,YAAY,gBAAGBC,MAAK,SAAShH,GAAU,IAAIA,EAAa,GAAG,KAAK,uCAAuC0G,GAae,IAAI,OAAO1G,E AAsB,iBAAMiH,OAAM,WAAW,OAAON,GAAUD,OAAuB,GAAGzJ,EAAW,OAAO,IAAIpB,SAAQ,SAASC,E AAQC,GAAQkB,EAAUyJ,IAAe,SAAS1G,GAAUIE,EAAQ,IAAIItsB,WAAWwwB,MAAYjE,MAAY,OAAOF,Q AAQC,UAAUkL,MAAK,WAAW,OAAOL,GAAUD,OAAkB,SAASQ,KAAa,IAAIC,EAak,CAACx5B,EAaiy5B ,IAAe,SAASC,EAAGBC,EAASC,GAAQ,IAAIC,EAAQF,EAASE,QAAQ5L,EAAY,IAAE4L,EAAsCvM,GAA9B D,EAAWY,EAAY,IAAK,GAAwClS,QAAQ20B,EAAUzI,EAAY,IAAK,EAAEkK,IAA6E,SAASgC,EAA0BC,G AAQV,EAAGBU,EAaiB,UAG,SAASC,EAAuBC,GAAU,OAAOpB,KAAmBG,MAAK,SAASnJ,GAAQ,OAAO 3D,YAAYgO,YAAYrK,EAAOsJ,MAAQH,KAAKiB,GAAS,SAASE,GAAQ5H,EAAI,0CAA0C4H,GAAQhK,GA AMgK,MAAomB,GAA37BtC,IAA87BjK,EAawB,gBAAG,IAAGe,OAAhDA,EAawB,gBAAEuL,EAAKE,GAAG C,MAAMxT,GAAGe,OAA7D0M,EAAI,sDAAsD1M,IAAU,EAAoD,OAAxyBwM,GAAsD,mBAAnCnG,YAAYk O,sBAAoC7B,GAAUG,KAAkBD,GAAUC,KAAgC,mBAARI,MAAsYkB,EAAuBF,GAaiYhB,MAAMJ,GAae,C AACK,YAAY,gBAAGBC,MAAK,SAAShH,GAAqE,OAAhD9F,YAAYkO,qBAAqBpI,EAASmH,GAAoBH,KAA Kc,GAA0B,SAASK,GAAuG,OAA/F5H,EAAI,kCAakC4H,GAAQ5H,EAAI,6CAAoDyH,EAAuBF,UAAkTb,MA AMtL,GAA0B,GAAG,SAASwJ,GAAqB0D,GAAW,KAAMA,EAU/5B,OAAO,GAAE,CAAC,IAAIi3B,EAAS8 C,EAAU3D,QAAQ,GAAoB,mBAAVva,EAAV,CAA0D,IAAI/E,EAak+E,EAAS/E,KAAsB,iBAAPA,OAAmCnG, IAAfkL,EAAS+C,IAAiBzE,EAAU91B,IAAIyyB,EAAdqD,GAA2BA,EAAU91B,IAAIyyB,EAAdqD,CAAoB0B,E AAS+C,KAAW9H,OAAoBnG,IAAfkL,EAAS+C,IAAGB,KAAK/C,EAAS+C,UAAxN/C,EAASnK,IAAsN,SAASy a,KAAIY,KAAQ,SAASkZ,GAAuBC,EAak1c,EAai2c,GAakTqB,EAAOuqB,WAAWF,EAak1c,EAaiA,EAai 2c,GAak,SAASgB,KAA4B,OAAOtrB,EAOne,OAAO,SAAS0pC,GAA0Bt/B,GAAM,IAAqG,OAAjG8hB,EA WYd,KAAkv/B,EAakxJ,EAAoi1B,WAAW,QAAQ,IAAI1J,EAA2BD,EAAWtrB,QAAe,EAAE,MAAMmkB,KAA K,SAAS6kB,GAAwBC,GAae,IAAIC,EAAQL,KAAgCM,EAAY,WAAW,GAAGF,EAACe,EAAa,OAAO,EAAM,IAAI,IAAIC,EAAQ,EAAEA,GAAS,EAAEA,GAAS,EAAE,CAAC,IAAIC,EAakBH,GAAS,EAAE,GAAGE,G AA6N,GAAPnC,EAakBlgC,KAAKmgC,IAAID,EAakBJ,EAAC,WAAshH,GAA/F3/B,KAAKmgC,IAAIH,EAAYjV,EAAQ/qB,KAAKC,IAAI6/B,EAACi,GAAMb,SAA2E,OAAO,EAAM,OAAO,EAahgHxS,GAAUG,MAAiBA ,GAaepJ,EAAWoJ,KAAi9G,IAAI2c,GAAS,CAACC,SAAS,GAAGrE,QAAQ,CAAC,KAAK,GAAG,IAAISe,UA AU,SAASC,EAAOC,GAAM,IAAI/zC,EAAO2zC,GAASpE,QAAQuE,GAakB,IAAPC,GAaiB,KAAPA,IAAqB,I AATD,EAAWp0C,EAImxB,GAakKc,EAakB/yB,EAAO,IAAIA,EAAOZ,OAAO,GAAOY,EAAO2C,KAAKox C,IAAQ/H,aAAQ7gB,EAAUtsB,IAAI,WAAqE,OAA1D80C,GAAS3H,SAAS,EAAUrgB,EAAOgoB,GAAS3H,Q AAQ,GAAG,IAAegI,OAAO,SAASvgB,GAA+B,OAAIBhB,EAAGB,IAAiBwgB,MAAM,SAASC,EAAIC,GAAM ,OAAOD,IAAM,SAASE,GAAUC,GAai,OAAO,EAAE,SAASC,GAASD,EAAGE,EAAWC,EAAYC,EAAOC,IA AY,SAASC,GAAUN,EAAGO,EAaic,EAAOC,GAAGB,IAAV,IAAIjN,EAAI,EAAUtmC,EAAE,EAAEA,EAAEs zC,EAAOtZ,IAAI,CAA2D,IAA1D,IAAIkyB,EAai9H,EAAOipB,EAAM,EAaFrzC,GAak,GAAOuwB,EAInG ,EAAOipB,GAAO,EAaFrzC,EAai,IAAI,GAAWsB,EAAE,EAAEA,EAAEivB,EAaijvB,IAAK8wC,GAASE,UA AUQ,EAAG92B,EAAOkW,EAai5wB,IAAIglC,GAak/V,EAawB,OAAPbnG,EAAOmpB,GAAM,GAAGjN,EA AW,EAAE,SAASkO,KAAkB,OAAO,EAAE,SAASW,KAAgB,OAAO,GAAG,SAAStQ,GAAS/vB,GAA4C,OAAR CsV,EAAO0a,MAAQb,GAAGhwB,EAAaA,EAAM,SAASsgC,GAASrI,GAAM,OAAOA,GAAM,KAAK,GAAG, OAAO,MAAM,KAAK,GAA8B,OAAOnF,OAAkB,KAAK,IAAI,KAAK,IAAI,KAAK,GAAG,KAAK,IAAI,KAAK



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in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.min.js.map

No license file was found, but licenses were detected in source scan.

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=====\n \*\n\nimport {backend\_util, GatherV2, GatherV2Attrs, GatherV2Inputs,

```

KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from
 './types';\n\nlet wasmGather: (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize: number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n
 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', //
 indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number' // outId\n]);\n\nfunction gatherV2(\n
 args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs});\n TensorInfo {\n const
 {backend, inputs, attrs} = args;\n const {x, indices} = inputs;\n const {axis, batchDims} = attrs;\n\n //
 Throw error when any index is out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const
 indicesVals = backend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let
 i = 0; i < indicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 &&
 index >= 0,\n () =>\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);\n }\n\n const
 shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
 batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
 shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
 indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
 {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n
 backend\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
 shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape,
 x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length
 - 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
 backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
 Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
 Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
 xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n
 backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape = shapeInfo.outputShape;\n return
 out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'wasm',\n
 setupFunc: setup,\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n"}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.js.map

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs,
 LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
 './backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number,
 leakyreluAlpha: number, outId: number) => void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs:
 LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }): TensorInfo {\n const { inputs: { x }, attrs:
 { alpha }, backend } = args;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API,
 LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape,
 'float32');\n\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n }\n\n return out;\n }\n\n export const leakyReluConfig:
 KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as
 {} as KernelFunc,\n };
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LeakyRelu.js.map

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the specific language governing
permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Maximum } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

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License.\n
 * =====\n
*/\nimport {KernelConfig, Rsqrt} from 'tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n"]}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nlet wasmTopK:\n (xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:\n boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool',\n // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk:\n (args:\n {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs,\n backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length -\n 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId =\n backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape,\n 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n });\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as { } as KernelFunc,\n };
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/TopK.js.map

No license file was found, but licenses were detected in source scan.

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```

```

=====
*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId:
 number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction
 setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number',
 // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n
]);\n}\n\nfunction oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n
 const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} =
 attrs;\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const
 indicesId = indicesData.id;\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n return
 out;\n}\n\nexport const oneHotConfig:
 KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
 {} as KernelFunc,\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/OneHot.js.map

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nt":["/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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```

```

=====
*\n\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Floor.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/unary.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/PadV2.h
- \*
- /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/BatchMatMul.h
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Equal.cc
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/SquaredDifference.cc
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Step.cc
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util }
from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number',
 // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n function maxPool(\n args: { inputs: MaxPoolInputs, backend: BackendWasm, attrs:
MaxPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n const x = inputs.x as Tensor4D;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // TF API supports int32 input. CPU and WebGL backend also support
int32\n // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n // TODO: add
support for int32 input.\n util.assert(\n x.dtype === 'float32',\n () =>`\n Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n const { filterSize,
strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape,
filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n if (convInfo.dataFormat !==
'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`);\n Please use 'channelsLast'.`;\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId
= backend.dataIdMap.get(out.dataId).id;\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n }\n export const maxPoolConfig:
KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool
as { } as KernelFunc\n};\n}]]
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-  
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No license file was found, but licenses were detected in source scan.

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```
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX:
number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n
'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', //
numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n
'number', // fillLength\n 'number', // outId\n]);\n}\n\nexport function rotateWithOffset(args: {\n inputs:
RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const
{ inputs, backend, attrs } = args;\n const { image } = inputs;\n const { radians, fillValue, center } = attrs;\n\n const out
= backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight,
imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,
```



```
radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const\nrotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n}]]
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RotateWithOffset.js.map
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No license file was found, but licenses were detected in source scan.

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```

governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from './Cast';\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args: {\n backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs;\n },\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' }});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n }\n}\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as KernelFunc\n};\n\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Mean.js.map

No license file was found, but licenses were detected in source scan.

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=====\n\*\n\nimport \* as tf from '@tensorflow/tfjs-core';\nimport {registerBackend, removeBackend, test\_util, util} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line:no-imports-from-dist\nimport {ALL\_ENVS, BROWSER\_ENVS, describeWithFlags} from '@tensorflow/tfjs-core/dist/jasmine\_util';\nimport {init, resetWasmPath} from './backend\_wasm';\nimport {BackendWasm, setWasmPath, setWasmPaths} from './index';\n\n/\*\*\n \* Tests specific to the wasm backend. The name of these tests must start with\n \* 'wasm' so that they are always included in the test runner. See\n \* `env.specFilter` in `setup\_test.ts` for details.\n \*/\ndescribeWithFlags('wasm read/write', ALL\_ENVS, () => {\n it('write and read values', async () => {\n const x = tf.tensor1d([1, 2, 3]);\n test\_util.expectArraysClose([1, 2, 3], await x.data());\n });\n it('allocate repetitively and confirm reuse of heap space', () => {\n const backend = tf.backend() as BackendWasm;\n const size = 100;\n // Allocate for the first time, record the memory offset and dispose.\n const t1 = tf.zeros([size]);\n const memOffset1 = backend.getMemoryOffset(t1.dataId);\n t1.dispose();\n // Allocate again and make sure the offset is the same (memory was reused).\n const t2 = tf.zeros([size]);\n const memOffset2 = backend.getMemoryOffset(t2.dataId);\n });\n});\n

```

// This should fail in case of a memory leak.\n expect(memOffset1).toBe(memOffset2);\n });\n\n it('allocates
buffers with byteOffsets', async () => {\n const data = [-0.5, 0.5, 3.14];\n const buffer = new ArrayBuffer(32);\n
const view = new Float32Array(buffer, 8, data.length);\n\n // Write values to buffer.\n for (let i = 0; i <
data.length; ++i) {\n view[i] = data[i];\n }\n\n const t = tf.tensor(view);\n // Tensor values should match.\n
test_util.expectArraysClose(await t.data(), view);\n });\n\n\n describeWithFlags('wasm init', BROWSER_ENVS,
() => {\n beforeEach(() => {\n registerBackend('wasm-test', async () => {\n const {wasm} = await init();\n
return new BackendWasm(wasm);\n }, 100);\n\n // Silences backend registration warnings.\n spyOn(console,
'warn');\n spyOn(console, 'log');\n });\n\n afterEach(() => {\n resetWasmPath();\n removeBackend('wasm-
test');\n });\n\n it('backend init fails when the
path is invalid', async () => {\n setWasmPath('invalid/path');\n let wasmPath: string;\n const realFetch =
fetch;\n spyOn(self, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n
});\n expect(await tf.setBackend('wasm-test')).toBe(false);\n expect(wasmPath).toBe('invalid/path');\n });\n\n
it('backend init fails when setWasmPaths is called with '+\n 'an invalid prefix',\n async () => {\n
setWasmPaths('invalid/prefix');\n let wasmPath: string;\n const realFetch = fetch;\n spyOn(self,
'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n });\n
expect(await tf.setBackend('wasm-test')).toBe(false);\n expect(wasmPath).toContain('invalid/prefix');\n });\n\n
it('backend init fails when setWasmPaths is called with '+\n 'an invalid fileMap',\n async () => {\n
setWasmPaths({\n 'tfjs-backend-wasm.wasm':
'invalid/path',\n 'tfjs-backend-wasm-simd.wasm': 'invalid/path',\n 'tfjs-backend-wasm-threaded-
simd.wasm': 'invalid/path'\n });\n let wasmPathPrefix: string;\n const realFetch = fetch;\n spyOn(self,
'fetch').and.callFake((path: string) => {\n wasmPathPrefix = path;\n return realFetch(path);\n });\n
expect(await tf.setBackend('wasm-test')).toBe(false);\n expect(wasmPathPrefix).toBe('invalid/path');\n });\n\n
it('setWasmPaths throws error when called without specifying a path for '+\n 'each binary',\n async () => {\n
expect(() => {\n setWasmPaths({\n 'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-
wasm.wasm'\n });\n }).toThrow();\n });\n\n it('backend init works when the path is valid and use
platform fetch',\n async () => {\n const usePlatformFetch = true;\n const validPrefix = '/base/wasm-out/';\n
setWasmPaths(validPrefix,
usePlatformFetch);\n let wasmPath: string;\n const realFetch = util.fetch;\n spyOn(util,
'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n });\n
expect(await tf.setBackend('wasm-test')).toBe(true);\n const validPaths = new Set([\n validPrefix + 'tfjs-
backend-wasm.wasm',\n validPrefix + 'tfjs-backend-wasm-simd.wasm',\n validPrefix + 'tfjs-backend-
wasm-threaded-simd.wasm',\n]);\n expect(validPaths).toContain(wasmPath);\n });\n\n it('backend init
works when the wasm paths overrides map is valid and '+\n 'using platform fetch',\n async () => {\n
const usePlatformFetch = true;\n const validPrefix = '/base/wasm-out/';\n setWasmPaths(\n {\n
'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-wasm.wasm',\n 'tfjs-backend-wasm-simd.wasm':\n
'/base/wasm-out/tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm':\n
'/base/wasm-out/tfjs-backend-wasm-threaded-simd.wasm'\n },\n usePlatformFetch);\n let wasmPath: string;\n
const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n
return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(true);\n const validPaths = new Set([\n
validPrefix + 'tfjs-backend-wasm.wasm',\n validPrefix + 'tfjs-backend-wasm-simd.wasm',\n validPrefix + 'tfjs-backend-
wasm-threaded-simd.wasm',\n]);\n expect(validPaths).toContain(wasmPath);\n });\n\n it('backend init
works when the path is valid and use platform fetch',\n async () => {\n const usePlatformFetch = true;\n
const validPath = '/base/wasm-out/tfjs-backend-wasm.wasm';\n setWasmPath(validPath, usePlatformFetch);\n
let wasmPath:
string;\n const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n wasmPath
= path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(true);\n
expect(wasmPath).toBe(validPath);\n });\n\n // Disabling this test because it intermittently times out on CI.\n //

```

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tslint:disable-next-line: ban\n xit('backend init fails when the path is invalid and use platform fetch',\n async ()
=> {\n const usePlatformFetch = true;\n setWasmPath('invalid/path', usePlatformFetch);\n let
wasmPath: string;\n const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n
wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-
test')).toBe(false);\n expect(wasmPath).toBe('invalid/path');\n });\n\n it('backend init succeeds with default
path', async () => {\n expect(await
tf.setBackend('wasm-test')).toBe(true);\n });\n\n it('setWasmPath called too late', async () => {\n // Set an invalid
path.\n setWasmPath('invalid/path');\n await tf.setBackend('wasm-test');\n\n // Setting the path too late.\n
expect(() => setWasmPath('too/late'))\n .toThrowError(/The WASM backend was already initialized. Make
sure/);\n });\n});\n}]]

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index\_test.js.map  
No license file was found, but licenses were detected in source scan.

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License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out =
backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as
number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName:
'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n}]]

```

Found

in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Fill.js.map  
No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"Sum.js","sourceRoot":"","sources":["../../src/kernels/Sum.ts"],"names":[],"mappings":"AAAA;:::
;:::;:::;GAeG;AAEH,OAAO,EAAC,YAAY,EAA4B,GAAG,EAAMc,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAI
zH,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,OAAO,EAAC,QAAQ,EAAC,MAAM,SAA
S,CAAC;AAEjC,IAAI,OACI,CAAC;AAET,SAAS,KAAC,CAAC,OAAoB;IACjC,OAAO,GAAG,OAAO,CAAC,I

```

AAI,CAAC,KAAC,CAAC,GAAG,EAAE,IAAI,CAAC,QAAQ,EAAE;QAC/C,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,GAAG,CAAC,IAAgE;IAE3E,MAAM,EAAC,OAAO,EAAE,MAAM,EAAE,KAAC,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,IAAI,EAAE,QAAQ,EAAC,GAAG,KAAC,CAAC;IAC/B,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;IACnB,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAI,OAAO,GAAG,GAAG,CAAC;IACIB,IAAI,KAAC,GAAG,CAAC,CAAC;IAEd,MAAM,EAAC,UAAU,EAAE,IAAI,EAAE,YAAY,EAAE,kBAakB,EAAC,GACtD,uBAaB,CAAC,CAAC,EAAE,IAAI,EAAE,OAAO,CAAC,CAAC;IAE9C,IAAI,aAAa,GAAG,IAAI,CAAC;IACzB,IAAI,kBAakB,EAAE;QACtB,MAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACjE,IAAI,YAAY,KAAC,GAAG,EAAE;YACxB,6DAA6D;YAC7D,oBAAoB;YACpB,KAAC,GAAG,UAAU,CAAC;YACnB,OAAO,GAAG,YAAY,CAAC;YACvB,aAAa,GAAG,YAAY,CAAC,gBAAgB,CACzC,aAAa,CAAC,MAAM,EAAE,KAAC,CAAC,KAAC,CAAC,MAAM,CAAC,CAAC;SAC/C;KACF;IAED,YAAY,CAAC,0BAA0B,CACnC,KAAC,EAAE,aAAa,EAAE,KAAC,CAAC,KAAC,CAAC,MAAM,CAAC,CAAC;IAC9C,MAAM,CAAC,QAAQ,EAAE,WAAW,CAAC,GACzB,YAAY,CAAC,yBAaYB,CAAC,KAAC,CAAC,KAAC,EAAE,aAAa,CAAC,CAAC;IACvE,MAAM,UAAU,GAAG,IAAI,CAAC,aAAa,CAAC,WAAW,CAAC,CAAC;IAEnD,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,KAAC,CAAC,KAAC,CAAC,CAAC;IACtD,IAAI,IAAI,CAAC,aAAa,CAAC,KAAC,CAAC,KAAC,CAAC,KAAC,CAAC,EAAE;QACzC,MAAM,KAAC,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACnD,OAAO,CAAC,OAAO,EAAE,UAAU,EAAE,QAAQ,CAAC,GAAG,CAAC,KAAC,CAAC,EAAE,KAAC,CAAC,CAAC;KACID;IAED,IAAI,kBAakB,EAAE;QACtB,oCAAoC;QACpC,OAAO,CAAC,WAAW,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC;KACxC;IAED,IAAI,QAAQ,EAAE;QACZ,UAAU;QACV,MAAM,QAAQ,GAAG,YAAY,CAAC,oBAAoB,CAAC,GAAG,CAAC,KAAC,EAAE,YAAY,CAAC,CAAC;QAC5E,GAAG,CAAC,KAAC,GAAG,QAAQ,CAAC;KACtB;IAED,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,SAAS,GAAiB;IACrC,UAAU,EAAE,GAAG;IACf,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAC;IACbB,UAAU,EAAE,GAAuB;CACpC,CAAC", "source sContent":["/\*\*\n

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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
```

```
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n}}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.js.map
```

No license file was found, but licenses were detected in source scan.

```
{"version":3,"file":"tf-backend-wasm.es2017.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/Maximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts","../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_util.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSuppressionV5.ts","../src/kernels/NotEqual.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pack.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/Range.ts","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Softmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts","../src/kernels/SquaredDifference.ts","../src/kernels/Step.ts","../src/kernels/StridedSlice.ts","../src/kernels/Sub.ts","../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../src/kernels/TopK.ts","../src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../src/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js","../wasm-out/tfjs-backend-wasm.js","../src/backend_wasm.ts","../src/version.ts","../src/base.ts"],"sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n */
```



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```
=====\n
\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport\nenum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu\n = 6\n}\n", "/\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You\n may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n by applicable law or agreed to in writing, software\n
```

```
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```

```
=====\n
\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { FusableActivation } from\n './types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null / void */, [\n\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', //\n b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', //\n activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' // out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend:\n BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b, bias,\n preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB,\n activation, leakyreluAlpha} = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =\n backend.dataIdMap.get(b.dataId).id;\n let biasId = 0;\n if (bias != null) {\n\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new\n Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 : \n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation = \n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw\n new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :\n b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],\n a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new\n Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
```

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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nexport function createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId: number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): \n TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)\n === 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {\n kernelName, backendName: 'wasm', setupFunc, kernelFunc;\n };\n}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions\n * and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nexport function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean, dtype?: \n DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId: \n number, bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* \n void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: \n BinaryInputs}): \n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId = \n backend.dataIdMap.get(a.dataId).id;\n const bId = \n backend.dataIdMap.get(b.dataId).id;\n const outputType = \n dtype != null ? dtype : a.dtype;\n const newShape = \n backend_util.assertAndGetBroadcastShape(a.shape, \n b.shape);\n const out = \n backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = \n new Uint8Array(new \n Int32Array(a.shape).buffer);\n const bShapeBytes = \n new Uint8Array(new \n Int32Array(b.shape).buffer);\n const
```

```

outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32')
{\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n
return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet `+\n
`supported for ${a.dtype} ${kernelName}.`);\n }\n\n return {kernelName, backendName: 'wasm', setupFunc,
kernelFunc};\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n",/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n\n function addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs,
backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-
sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n }\n\n export const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport

```

```

{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as {} as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
 './Identity';\n\nimport {CppType}
from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
CppType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n
'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n
'array', // perm\n 'number', // perm.length\n]);\n\n export function transpose(\n args: {\n inputs: TransposeInputs, backend:
BackendWasm, attrs: TransposeAttrs);\n TensorInfo {\n const {inputs, backend, attrs} = args;\n // Reduce any
dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n\n let permIsNoOp = true;\n for
(let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId:
inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n\n if (permIsNoOp) {\n const cloned =
identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return
out;\n }\n\n function computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n }\n\n function
removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[] =
[];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i && \n (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n }\n newPerm[minValIdx] = i;\n }\n }\n return [newShape, newPerm];\n }\n\n export const transposeConfig:
KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as {} as KernelFunc,\n setupFunc: setup,\n };\n\n ", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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=====
*\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {transpose} from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose
if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n *\n * @param axis reduction axes\n *\n * @param backend wasm backend instance\n *\n * @export function permuteAxesAndTranspose(\n * x: TensorInfo,
axis: number|number[],
backend: BackendWasm): {\n * transposed: TensorInfo|null,\n * axes: number[],\n * originalAxes: number[],\n * inputWasTransposed: boolean\n * } {\n * const xShape = x.shape;\n * const xRank = x.shape.length;\n * const
originalAxes = util.parseAxisParam(axis, xShape);\n * let axes = originalAxes;\n * const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n * let xTransposed = null;\n * let inputWasTransposed = false;\n * if
(permutedAxes != null) {\n * const newShape: number[] = new Array(xRank);\n * for (let i = 0; i <
newShape.length; i++) {\n * newShape[i] = xShape[permutedAxes[i]];\n * }\n * axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n * xTransposed =\n * transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n * const xId = backend.dataIdMap.get(x.dataId).id;\n * const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n * if (transposedId !== xId) {\n * inputWasTransposed = true;\n *
}\n * }\n * return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};\n * }\n\n"/**\n * @license\n * Copyright 2021 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from
'./kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n * wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,
number']);\n * }\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n * TensorInfo {\n * const {backend, inputs, attrs} = args;\n * const {axis, keepDims} = attrs;\n * const {x} = inputs;\n * const xId =
backend.dataIdMap.get(x.dataId).id;\n * let inputId = xId;\n * let input = x;\n * const {transposed, axes, originalAxes,
inputWasTransposed} =\n * permuteAxesAndTranspose(x, axis, backend);\n * if (inputWasTransposed) {\n * const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n * input = transposed;\n * inputId =
transposedId;\n * }\n * const inputRank = input.shape.length;\n * backend_util.assertAxesAreInnerMostDims('all',
axes, inputRank);\n * const [outShape, reduceShape] =\n * backend_util.computeOutAndReduceShapes(input.shape, axes);\n * const reduceSize = util.sizeFromShape(reduceShape);\n * const out = backend.makeOutput(outShape, x.dtype);\n * if (util.sizeFromShape(input.shape) !== 0) {\n * const outId = backend.dataIdMap.get(out.dataId).id;\n * wasmAll(inputId, reduceSize, outId);\n * }\n * if (inputWasTransposed) {\n * // dispose of the transposed tensor.\n * backend.disposeData(transposed.dataId);\n * }\n * if (keepDims) {\n * // reshape\n * const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n * out.shape = newShape;\n * }\n * return
out;\n * }\n\nexport const allConfig: KernelConfig = {\n * kernelName: All,\n * backendName: 'wasm',\n * setupFunc:
setup,\n * kernelFunc: all as {} as KernelFunc\n * };\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
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```

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```
=====\n*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nlet wasmAny: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any, null /*void*/, [number, number, number]);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: any as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmFunc: (\n xId: number, dtype: number, outerSize: number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as { } as ArgMaxAttrs;\n const { x } = inputs as { } as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let\n inputId = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n}\n\nif
```

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(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n
 kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
 const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
 const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
 const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
 throw new Error(\n `wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1],`\n
 +\n `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =

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inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount
for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n);\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n
kernelFunc: reshape as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*/\n\nimport
{BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const
\n {transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions
\n must either be the ` +\n `same or at least one input batch dimension must be 1. Got input ` +\n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and (` +\n `-${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n `-${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation
\n is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape:
a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n const leftDim =

```





FBRyxHQUFHLEtBQUssQ0FBQyxLQUFLENBQUMsQ0FBQyxDQUFDLEVBQUUsRUFBRsXHQUFHLEVB  
QUU7b0JBQzdDLE9BQU8sQ0FBQyxNQUFNLEdBQUcsR0FBRyxDQUFDLEdBQUcsV0FBVyxDQUFDLEIBQ  
UksRUFBRsxDQUFDLENBQUM7aUJBQzdDO2FBQ0Y7WUFFRCxTQUFTLEIBQUksS0FBsYxDQUFDLEtB  
QUssQ0FBQyxDQUFDLENBQUMsQ0FBQzRQUM5QixDQUFDLENBQUMsQ0FBQzLQUNKO0IBRUQsT0F  
BTyxPQUFPLENBQUM7QUFDakIsQ0FBQyIsInNvdXJzXNDb250ZW50Ijpbli8qKlxuICogQGxpY2Vuc2VcbiA  
qIENvcHlyaWdodCAyMDIwIEedvb2dsZSBMTEMuIEFsbCBSaWdodHMGUwVzZXJ2ZWQuXG4gKiBMAWNlbn  
NIZCB1bmRlciB0aGUgQXBhY2hlIExpY2Vuc2U5IFZlcuNpb24gMi4wICh0aGUgXCJMaWNlbnNIXCIpO1xuICo  
geW91IG1heSBub3QgdXNlIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHRoZSBMaWNlbn  
nNILlxuICogWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHRoZSBMaWNlbnNIIGF0XG4gKlxuICogaHR0cDov  
L3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJQ0VOU0UtMi4wXG4gKlxuICogVW5sZXNzIHJlcXVpcmVkJG5I  
GFwcGxpY2FibGUgGF3IG9yIGFncmVIZCB0byBpb3B3cm10aW5nL0Y2Vuc2VzZDZ0d2ZyZVZuICogZGlzdHJpYnV0Z  
WQgdW5kZXIgdGhlIExpY2Vuc2UgaXMGZGlzdHJpYnV0ZVZQgb24gYW4gXCJBuYBU1wiEJBU0ITLFXuICo  
gV0IUSE9VVCBXQVJSQU5USUVVIE9SIENPTkRJEIPTIMgt0YgQU5ZIEtJTkQsIGVpdGhlcilBleHByZXNzI  
G9yIGltcGxpZWQuXG4gKiBTZWUgdGhlIExpY2Vuc2UgZm9yIHRoZSBzcGVjaWZpYyBsYW5ndWFnZSBnb3  
Zlcm5pbmcgcGVybwWlzc2lbnMgYW5kXG4gKiBsaW1pdGF0aW9ucyB1bmRlciB0aGUgTGJlZW5zZS5cbiAqID  
09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09  
PT09PT09PT09PT09XG4gKi9cb1xuaW1wb3J0IHtiYWNRZW5kX3V0aWwslEJhY2tlbmRWYXx1ZXMsIERhdG  
FUeXBILCBUEXBIZEFycmF5L0Y2Vuc2VzZDZ0d2ZyZVZuICogZGlzcmlmcm9tIDAdGVuc29yZmxvdy90ZmpzLWNvcuUnO1xuXG5leHBv  
cnQgZnVuY3Rpb24gY29uY2F0SW1wbChcbiAgICBpb3B1dHM6IEFycmF5PHt2YWxzOiBCYWRnZW5kVmFsd  
WVzLCBzaGFwZTogbnVtYmVyW119Piwgb3V0U2hhcGU6IG51bWJlcldLFxuICAgIGR0eXBIOiBEYXRhVHl  
wZSwgc2ltcGx5Q29uY2F0OiBib29sZWwFuKtVgVHlwZWRBcnJheXxzdHJpbmduXSB7XG4gIGNvbnN0IG91dF  
ZhbHMgPSB1dGlsLmdldEFycmF5RnJvbnURUEXBILCB1dGlsLnNpemVGM9tU2hhcGUob3V0U2hh  
cGUpKtcb1xucBpZiAoc2ltcGx5Q29uY2F0ICYmIGR0eXBIIICE9PSAnc3RyaW5nJkYge1xuICAgIC8vIFVzZSBi  
dWsdC1pb1BUeXBIZEFycmF5LnNldCgpIG1ldGhvZCBmb3IgczBIZWQuXG4gICAgbGV0IG9mZnNldCA9IDA  
7XG4gICAgaw5wdXRzLmZvckVhY2goaw5wdXQgPT4ge1xuICAgICAgY29uc3Qgc2l6ZSA9IHV0aWwuc2l6Z  
UZyb21TaGFwZShpb3B1dC5zaGFwZSk7XG5cbiAgICAgIChdXRWYXxzIGFzIFR5cGVkQXJyYXkpbLnNldCh  
pb3B1dC52YWxzIGFzIFR5cGVkQXJyYXksIG9mZnNldCk7XG4gICAgICBvZmZzZXQgKz0gc2l6ZTtcbiAgICB  
9KTtcbiAgfSB1bnNldCcbiAgICBszXQgY29sT2Zmc2V0ID0gMDtcb1xucBpZiAgICglucHV0cy5mb3JFYWNoKGluc  
HV0ID0+IHtcbiAgICAgIGNvbnN0IGRIY29kZWREYXRhID0gZHR5cGUGPT09ICdzdHJpbmduID9cbiAgICAgI  
CAgICBvZmZzZXQgKz0gc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6Z  
JyYX1bXSkge1xuICAgICAgICglucHV0LnZhbHMgYXMGVHlwZWRBcnJheXxzdHJpbmduXSB7XG4gICAgbGV0IHRJZ  
HggPSAW01xuXG4gICAgICBmb3IgKgxldCBvbnNldCgpPSAW0yByb3cgPCBpb3B1dC5zaGFwZVZswXTsgKytyb3cp  
IHtcbiAgICAgICAgY29uc3Qgc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6Z  
gICAgICZvciAobGV0IGNvbCA9IDA7IGNvbCA8IGlucHV0LnNoYXBlWzFzYXJzZW50aWwuc2l6ZSA9IHV0aWwuc2l6Z  
AgICAgICglucHV0LnNoYXBlWzFzYXJzZW50aWwuc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6ZSA9IHV0aWwuc2l6Z  
gICAgIC1cb1xucBpZiAgICAgY29sT2Zmc2V0ICs9IGlucHV0LnNoYXBlWzFzYXJzZW50aWwuc2l6ZSA9IHV0aWwuc2l6Z  
mV0dXJhIG91dFZhbHM7XG59XG4iXX0=,"/>  
\*/\*\*\n

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the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n \*^nimport { util } from '@tensorflow/tfjs-core';\nexport function rangeImpl(start, stop, step, dtype) {\n const  
sameStartStop = start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const  
decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop || increasingRangeNegativeStep ||\n









```

outVals.set(res);\n }\n\n return out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride:
number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i =
beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset +
size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction
slice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:
backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =
beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <
endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:
backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number,
number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK =
begin[2];\n
const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL =
begin[3];\n\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k <
endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n
outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc:
slice as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n\n const
permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n\n const xTransposed =\n
transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n\n const xTransposedReshaped = reshape(\n
{inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n
attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed

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```
=====
*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const castConfig:\n KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as { } as\n KernelFunc,\n };
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```

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=====
*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
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```

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=====
\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\n number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =\n backend.wasm.cwrap(ClipByValue, null / void */, [\n 'number', // x_id\n 'number', // min\n 'number', //\n max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:\n BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig:\n KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip\n as { } as KernelFunc\n };
"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```



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=====
*/\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {concatImplCPU} from
'./kernel_utils/shared';\n\nimport {identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nexport function
concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t
=> t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype === 'string') {\n //
Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional
tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis
to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these
two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to
have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors
along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n
const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape
=\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n
const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n
const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b *
sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset =
b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals,
outOffset);\n outOffset += innerDim;\n }\n }\n return out;\n }\n\nexport const concatConfig: KernelConfig =
{\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n};\n\n"/**\n *
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the License.\n *
=====
*/\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,

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inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,
 null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n ` ${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number,
xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n
'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n
'number', //

```

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outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', //
xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number',
// yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n
'number', // yChannelStride\n 'number', // outId\n]);\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n
const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n *
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from

```

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'/unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { cast }
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest
= 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n
 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n
 'number', // extrapolation value\n 'number' // out id\n]);\n}\n\nfunction cropAndResize(args: {\n backend:
BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend,
inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} =
inputs;\n const numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number,
number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData =
backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const
out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n wasmCropAndResize(\n imagesId,
boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n InterpolationMethod[method as {}] as keyof typeof
InterpolationMethod,\n extrapolationValue, outId);\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n}\n\nexport const cropAndResizeConfig:
KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
cropAndResize as {} as KernelFunc\n};\n", "/*\n *
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from
 './types';\n\nimport { transpose } from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n
 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n

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out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n
 setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from
'./backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number, inputHeight: number,
inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n
padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number,
dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend:
BackendWasm,\n attrs: DepthwiseConv2dNativeAttrs\n}) {\n const {inputs, attrs, backend} = args;\n\n const {x,
filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n const
$dilations = dilations == null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad,
dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth
= convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n
const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend DepthwiseConv2dNative does not support dataFormat: ` +\n
`${convInfo.dataFormat}`. Please use
'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n filterWidth,
 padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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```
=====\n*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,\nKernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nexport function expandDims(args: {\ninputs: ExpandDimsInputs,\nattrs: ExpandDimsAttrs,\nbackend: BackendWasm\n}) {\nconst {inputs, attrs, backend} = args;\nconst {input} = inputs;\nconst {dim} = attrs;\nconst inputRank = input.shape.length;\nconst newShape = input.shape.slice();\nlet $dim = dim;\nif (dim < 0) {\n// Negative value is counted from the tail of rank.\nutil.assert(\n-(inputRank + 1) <= dim,\n() => `Axis must be in the interval [${-(inputRank + 1)}, ${\ninputRank}]`);\n$dim = inputRank + dim + 1;\n}\nnewShape.splice($dim, 0, 1);\nreturn reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\nkernelName: ExpandDims,\nbackendName: 'wasm',\nkernelFunc: expandDims as {} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
```

the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { Fill, FillAttrs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function fill(args: { attrs: FillAttrs, backend: BackendWasm }) {\n const { attrs: { shape, value, dtype }, backend } = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: { inputs: FlipLeftRightInputs, backend: BackendWasm }): TensorInfo {\n const { inputs, backend } = args;\n const { image } = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { FloorDiv, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =
```



createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n *\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet\nwasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {FusableActivation} from './types';\n\nlet\nwasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\nvoid;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n],\n
```



```

void;

function setup(backend: BackendWasm) {
 wasmFusedDepthwiseConv2d =
 backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [
 'number', // xId
 'number', // batchSize
 'number', // inputHeight
 'number', // inputWidth
 'number', // filterId
 'number', // filterHeight
 'number', // filterWidth
 'number', // biasId
 'number', // padTop
 'number', // padRight
 'number', // padBottom
 'number', // padLeft
 'number', // isSamePad
 'number', // dilationHeight
 'number', // dilationWidth
 'number', // strideHeight
 'number', // strideWidth
 'number', // inputChannels
 'number', // outputChannels
 'number', // activation
 'number', // preluActivationWeightsId
 'number', // leakyreluAlpha
 'number', // outId
]);

 function fusedDepthwiseConv2d(args: {
 inputs: FusedDepthwiseConv2DInputs,
 backend: BackendWasm,
 attrs: FusedDepthwiseConv2DAttrs
 }) {
 const {inputs, attrs, backend} = args;
 const {x, filter, bias, preluActivationWeights} = inputs;
 const {
 strides,
 pad,
 dilations,
 dataFormat,
 dimRoundingMode,
 activation,
 leakyreluAlpha
 } = attrs;

 const convInfo =
 backend_util.computeConv2DInfo(
 (x as Tensor4D).shape, (filter as Tensor4D).shape,
 strides, dilations,
 pad, dimRoundingMode, true /* depthwise */
);

 const fusedActivation =
 FusableActivation[activation as key of type of FusableActivation];

 if (fusedActivation == null) {
 throw new Error(
 `${activation} activation not yet supported for FusedDepthwiseConv2D`
 + ` in the wasm backend.`
);
 }

 const xId = backend.dataIdMap.get(x.dataId).id;
 const filterId = backend.dataIdMap.get(filter.dataId).id;
 const outputChannels = convInfo.outChannels;

 let biasId = 0;
 if (bias != null) {
 const biasData = backend.dataIdMap.get(bias.dataId);
 if (biasData.shape.length !== 1) {
 throw new Error(
 `FusedDepthwiseConv2D only supports rank-1 bias but got`
 + ` rank ${biasData.shape.length}`
);
 }
 if (biasData.shape[0] !== outputChannels) {
 throw new Error(
 `FusedDepthwiseConv2D bias shape (${biasData.shape}) does not`
 + ` match the number of output channels (${outputChannels})`
);
 }
 biasId = biasData.id;
 }

 const filterHeight = convInfo.filterHeight;
 const filterWidth = convInfo.filterWidth;
 const padTop = convInfo.padInfo.top;
 const padRight = convInfo.padInfo.right;
 const padBottom = convInfo.padInfo.bottom;
 const padLeft = convInfo.padInfo.left;
 const dilationHeight = convInfo.dilationHeight;
 const dilationWidth = convInfo.dilationWidth;
 const strideHeight = convInfo.strideHeight;
 const strideWidth = convInfo.strideWidth;
 const inputChannels = convInfo.inChannels;
 const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
 const batchSize = convInfo.batchSize;
 const inHeight = convInfo.inHeight;
 const inWidth = convInfo.inWidth;

 if (dataFormat !== 'NHWC') {
 throw new Error(
 `wasm backend FusedDepthwiseConv2D does not support dataFormat:`
 + `${dataFormat}. Please use 'NHWC'`
);
 }

 const out = backend.makeOutput(convInfo.outShape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;

 wasmFusedDepthwiseConv2d(
 xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,
 biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,
 dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,
 fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId
);

 return out;
 }

 export const fusedDepthwiseConv2DConfig: KernelConfig = {
 kernelName: FusedDepthwiseConv2D,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: fusedDepthwiseConv2d
 } as KernelFunc;
}

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 */

```

```

*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n
 sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n
 'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
 sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}): \n TensorInfo {\n const {backend, inputs} = args;\n const
{params, indices} = inputs;\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n const out = backend.makeOutput(resultShape,
params.dtype);\n if (numSlices === 0) {\n return out;\n }\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n
 const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n return out;\n}\n\nexport const gatherNdConfig:
KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
gatherNd\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'../backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n
 'array', // outStrides\n 'number' // outId\n]);\n\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm,
inputs: GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const
{x, indices} = inputs;\n const {axis, batchDims} = attrs;\n // Throw error when any index is out of bound.\n
const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId)
as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const
index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2:
the index value ${index} is not in [0, ${axisDim - 1}]);\n }\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n
 shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n
backend\n });\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n
inputs: {x: indices},\n attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n
});\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length

```

```

- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n
 const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n"/**\n
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }
from '/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from
'/types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n
 'number', //
out_id\n]);\n\n export function leakyRelu(\n args: \n {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)

```

```
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,\n outId);\n }\n\n return out;\n}\n\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n};\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessConfig: KernelConfig =\n\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n",/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law\n * or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\n\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n",/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig =\n\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n",/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License
```

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```
=====
*import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';import {BackendWasm} from '../backend_wasm';import
{permuteAxesAndTranspose} from './kernel_utils';import {CppType} from './types';let wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) => void;
function setup(backend: BackendWasm): void {
 wasmMax = backend.wasm.cwrap(Max, null /*void*/, [number, // x_id
number, // dtype
number, // reduce_size
number, // out_id
]);
function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {
 const {backend, inputs, attrs} = args;
 const {reductionIndices: axis, keepDims} = attrs;
 const {x} = inputs;
 const xId = backend.dataIdMap.get(x.dataId).id;
 let inputId = xId;
 let input = x;
 const {transposed, axes, originalAxes, inputWasTransposed} =
permuteAxesAndTranspose(x, axis, backend);
 if (inputWasTransposed) {
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;
 input = transposed;
 inputId = transposedId;
 }
 const inputRank = input.shape.length;
 backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);
 const [outShape, reduceShape] =
backend_util.computeOutAndReduceShapes(input.shape, axes);
 const reduceSize =
util.sizeFromShape(reduceShape);
 const out = backend.makeOutput(outShape, x.dtype);
 if (util.sizeFromShape(input.shape) !== 0) {
 const outId = backend.dataIdMap.get(out.dataId).id;
 wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);
 }
 if (inputWasTransposed) {
 // dispose of the transposed tensor.
 backend.disposeData(transposed.dataId);
 }
 if (keepDims) {
 // reshape
 const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
 out.shape = newShape;
 }
 return out;
}
export const maxConfig: KernelConfig = {
 kernelName: Max,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: max as {} as KernelFunc
};
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 */
=====
```

```
=====
*import {KernelConfig, Maximum} from '@tensorflow/tfjs-core';import {createBinaryKernelConfig} from
'./binary_kernel';const supportsFullBroadcast = false;export const maximumConfig: KernelConfig =
createBinaryKernelConfig(Maximum, supportsFullBroadcast);
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 */
=====
```

```
=====
*import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';import {BackendWasm} from '../backend_wasm';let wasmMaxPool: (
 xId:
 number, batchSize: number, inputHeight: number, inputWidth: number,
 filterHeight: number, filterWidth:
 number, padTop: number, padRight: number,
 padBottom: number, padLeft: number, dilationHeight: number,
 dilationWidth: number) => Tensor4D;
function setup(backend: BackendWasm): void {
 wasmMaxPool = backend.wasm.cwrap(MaxPool, null /*void*/, [
 number, // x_id
 number, // batch_size
 number, // input_height
 number, // input_width
 number, // filter_height
 number, // filter_width
 number, // pad_top
 number, // pad_right
 number, // pad_bottom
 number, // pad_left
 number, // dilation_height
 number, // dilation_width
]);
}
export const maxPoolConfig: KernelConfig = {
 kernelName: MaxPool,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: maxPool as {} as KernelFunc
};
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 */
=====
```





```

transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\nbackend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype:
'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig: KernelConfig = {\n
kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
 {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min,
 null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n
]);\n\n function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}):\n TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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=====
*\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google
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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
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=====
*\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n// Must match
 enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
 xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
 Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad =
 backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
 x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', //
 mode\n 'number', // outId\n]);\n}\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend:
 BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n
 const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n
 const xId =
 backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new
 Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const
 postPaddingsFlat = paddings.map(padTuple
 => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n
 const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n
 wasmMirrorPad(\n xId, xShapeBytes, x.shape.length, CCppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig:
 KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as
 KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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=====
*\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google
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```
=====\n*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in `non_max_suppression_impl.h`\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`\n */\nexport function parseResultStruct(\n backend: BackendWasm, resOffset: number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3, 'number', [\n Result*\n ['number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n}\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n return selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {\n KernelFunc,\n };,\n "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```
=====
*
import { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import { parseResultStruct } from './NonMaxSuppression_util';
let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number,
iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean) => number;
function setup(backend: BackendWasm): void {
 wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV4, 'number',
 ['number', // boxesId
 'number', // scoresId
 'number', // maxOutputSize
 'number', // iouThreshold
 'number', // scoreThreshold
 'bool', // padToMaxOutputSize
]);
 function nonMaxSuppressionV4(args: {
 backend: BackendWasm,
 inputs: NonMaxSuppressionV4Inputs,
 attrs: NonMaxSuppressionV4Attrs
 }): TensorInfo[] {
 const { backend, inputs, attrs } = args;
 const { iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize } =
 attrs;
 const { boxes, scores } = inputs;
 const boxesId = backend.dataIdMap.get(boxes.dataId).id;
 const scoresId = backend.dataIdMap.get(scores.dataId).id;
 const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold,
 scoreThreshold, padToMaxOutputSize);
 const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =
 parseResultStruct(backend, resOffset);
 // Since we are not using scores for V4, we have to delete it from the heap.
 backend.wasm._free(pSelectedScores);
 const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32',
 pSelectedIndices);
 const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);
 return [selectedIndicesTensor, validOutputsTensor];
 }
 export const nonMaxSuppressionV4Config: KernelConfig = {
 kernelName: NonMaxSuppressionV4,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: nonMaxSuppressionV4 as KernelFunc
 };
}
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 */
=====
*
import { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import { parseResultStruct } from './NonMaxSuppression_util';
let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number,
iouThreshold: number, scoreThreshold: number, softNmsSigma: number) => number;
function setup(backend: BackendWasm): void {
 wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV5, 'number',
 ['number', // boxesId
 'number', // scoresId
 'number', // maxOutputSize
 'number', // iouThreshold
 'number', // scoreThreshold
 'number', // softNmsSigma
]);
 function kernelFunc(args: {
 backend: BackendWasm,
 inputs: NonMaxSuppressionV5Inputs,
 attrs: NonMaxSuppressionV5Attrs
 }): TensorInfo[] {
 const { backend, inputs, attrs } = args;
 const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma } =
 attrs;
 const { boxes, scores } = inputs;
 const boxesId = backend.dataIdMap.get(boxes.dataId).id;
 const scoresId = backend.dataIdMap.get(scores.dataId).id;
 const
```

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resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from\n the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n\n\n\nexport const nonMaxSuppressionV5Config:\nKernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as KernelFunc,\n};\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n*/\nimport\n { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n", /**\n * @license\n * Copyright 2020\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n*/\nimport\n { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-core';\n\nimport\n { BackendWasm } from '../backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue:\n number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\n function oneHot(\n args:\n { inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm }) {\n const { inputs, backend, attrs } = args;\n const { indices } = inputs;\n const { depth, onValue, offValue } = attrs;\n\n const out =\n backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth,\n onValue, offValue, outId);\n\n return out;\n }\n\n export const oneHotConfig: KernelConfig = {\n kernelName:\n OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as { } as KernelFunc,\n }; \n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * \n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n =====\n\n*/\nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs }

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from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nfunction onesLike(args:
{inputs: OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName:
'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
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OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {concat} from './Concat';\nimport
{expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend,
attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n
 dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =
expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n });\n\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n 'number', // xId\n 'array', //
x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-
paddings\n 'number', // constantValue\n 'number', // outId\n]);\n}\n\nfunction pad(\n args: {inputs:
PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings,
constantValue}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1]
/* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't
have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs:
{shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId =

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backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n
new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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\n
*/\nimport { KernelConfig, Pow } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n
createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { cast } from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\nfunction prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n const { inputs, backend
} = args;\n const { x, alpha } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n
let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({ backend, inputs: { x },
attrs: { dtype: 'float32' });\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =
backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number',\n 'number',\n 'number'\n
]);\n}\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes =
axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if
(transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are
done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =
backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape]
= \n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmProd(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const
range =\n (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n const {backend, attrs} =
args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n
const
out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n
outVals.set(values);\n return out;\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n
backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport
{createUnaryKernelConfig} from './unary_kernel';\n\nexport const relu6Config: KernelConfig =
createUnaryKernelConfig(Relu6);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmResizeBilinear: (\n xId:
number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,
newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null
/*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n
'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n
'number', // halfPixelCenters\n 'number' // outId\n]);\n\n function resizeBilinear(args: {\n backend:
BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }): TensorInfo {\n const {backend,
inputs, attrs} = args;\n\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size}
= attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if

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(castedData != null) {\n backend.disposeData(castedData.dataId);\n } \n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n
 backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n]);\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length
=== 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { backend_util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', // imageWidth\n
'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', //
fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n}\n\nexport function rotateWithOffset(args: {\n
inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n
const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n

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backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const\n fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,\n fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new\n Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,\n radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const\n rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS
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OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions\n and\n * limitations under the License.\n */
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=====\n\n*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific
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language governing permissions and\n * limitations under the License.\n */
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=====\n\n*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */
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=====\n\n*/\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}\n from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppDType} from\n './types';\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:\n number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)\n => void;\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,\n null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //\n sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\nfunction scatterNd(\n args:\n {backend: BackendWasm, inputs:\n ScatterNdInputs, attrs:\n ScatterNdAttrs});\n\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape)\n === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =\n backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
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backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
 Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,
 stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n
 kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020
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 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
 =====\n
 *\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport
 { BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId:
 number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect
 = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n
 'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: { inputs: SelectInputs, backend:
 BackendWasm }) {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n\n const conditionId =
 backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
 backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
 t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
 const selectConfig:
 KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { } as KernelFunc,\n
 setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
 under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *
 =====\n
 *\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
 core';\n\nimport { BackendWasm }
 from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
 BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
 'number']);\n}\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n TensorInfo {\n
 const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
 backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit
 zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n
 return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName:
 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright
 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
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 in compliance with the License.\n * You may obtain a copy of the License at\n *
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```
=====\n*\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n
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```

```
=====\n*\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmFunc: (xId: number, outId: number, channels: number, batch: number) =>\n void;\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n function softmax(\n args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}):\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} = args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape, logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return out;\n }\n export const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n }; \n} \n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n
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```

```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {padV2Config} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\nfunction spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<[number, number]> = [[0, 0];\n completePaddings.push(...(paddings as Array<[number, number]>));\n for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX = padV2Config.kernelFunc({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:\n
```

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ReshapeAttrs = {shape: reshapedPaddedShape};\n
 const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n"/**\n * @license\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs,
attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s
=> {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"/**\n * @license\n *
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n"/**\n *

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```
=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) =>\n void;\nfunction setup(backend: BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\nfunction step(\n args: {\n backend: BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype], outId);\n return out;\n}\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {\n as KernelFunc\n };,\n", "/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array, xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n}\nexport function stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n
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finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n
} =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n
newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n
backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n
new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n"/**\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n
createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
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the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n 'number', // dtype\n
'number', // out_id\n]);\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const

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{x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n", "/*\n * @license\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //
x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n

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]);\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return\n out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC.

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/\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTopK: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted: boolean,\n outValuesId: number, outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null / void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topK: (\n args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes =\n new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =\n backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length,\n CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: topK as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR

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CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,

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null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n
'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number',
// imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //
interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n}\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n
const out = backend.makeOutput(outShape, image.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n
fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n
fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n
return out;\n}\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {slice} from
'./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\n
TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype,
shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName:
'wasm',\n kernelFunc: unpack as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm }
from './backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend: BackendWasm }) {\n
const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as {} as
KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *

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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\nimport { fusedMatMulConfig }
from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from
 './kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport
{ anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig }
from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport
{ batchToSpaceNDConfig } from './kernels/BatchToSpaceND';\nimport { castConfig } from './kernels/Cast';\nimport
{ ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig } from './kernels/ClipByValue';\nimport
{ concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from './kernels/Conv2D';\nimport
{ conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport { cosConfig } from
 './kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig } from
 './kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport { depthToSpaceConfig }
from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from
 './kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from
 './kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from
 './kernels/ExpandDims';\nimport { fillConfig } from './kernels/Fill';\nimport { flipLeftRightConfig } from
 './kernels/FlipLeftRight';\nimport { floorConfig } from './kernels/Floor';\nimport { floorDivConfig } from
 './kernels/FloorDiv';\nimport
{ fusedBatchNormConfig } from './kernels/FusedBatchNorm';\nimport { fusedConv2DConfig } from
 './kernels/FusedConv2D';\nimport { fusedDepthwiseConv2DConfig } from
 './kernels/FusedDepthwiseConv2D';\nimport { gatherNdConfig } from './kernels/GatherNd';\nimport
{ gatherV2Config } from './kernels/GatherV2';\nimport { greaterConfig } from './kernels/Greater';\nimport
{ greaterEqualConfig } from './kernels/GreaterEqual';\nimport { identityConfig } from './kernels/Identity';\nimport
{ leakyReluConfig } from './kernels/LeakyRelu';\nimport { lessConfig } from './kernels/Less';\nimport
{ lessEqualConfig } from './kernels/LessEqual';\nimport { logConfig } from './kernels/Log';\nimport
{ logicalAndConfig } from './kernels/LogicalAnd';\nimport { maxConfig } from './kernels/Max';\nimport
{ maximumConfig } from './kernels/Maximum';\nimport { maxPoolConfig } from './kernels/MaxPool';\nimport
{ meanConfig } from './kernels/Mean';\nimport { minConfig } from './kernels/Min';\nimport { minimumConfig } from
 './kernels/Minimum';\nimport
{ mirrorPadConfig } from './kernels/MirrorPad';\nimport { multiplyConfig } from './kernels/Multiply';\nimport
{ negConfig } from './kernels/Neg';\nimport { nonMaxSuppressionV3Config } from
 './kernels/NonMaxSuppressionV3';\nimport { nonMaxSuppressionV4Config } from
 './kernels/NonMaxSuppressionV4';\nimport { nonMaxSuppressionV5Config } from

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./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
./kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
./kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
./kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n
 argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n
 ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n
 cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n
 depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n
 flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n
 fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n
 gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n
 leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n
 maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n
 multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n
 nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n
 padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n
 relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n
 rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n
 softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
 squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
 tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
 zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport { env } from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array\n passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that\n contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new\n Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,\n 11\n]));\n\n/**\n * True if threads are supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-\nfeature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //\n TODO(annxingyuan): Enable node support once this is resolved:\n //\n https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n // Test for transferability of SABs (needed for Firefox)\n //\n https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new\n MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly\n program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,\n 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,\n 11\n]));\n } catch (e) {\n return false;\n }\n});\n\n",\n\nvar WasmBackendModuleThreadedSimd = (function() {\n var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :\n undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return\n (\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =\n WasmBackendModuleThreadedSimd || {};\n\nfunction\n GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n return\n HEAP8}\nfunction\n GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n }return HEAPU8}\nfunction\n GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n }return HEAP32}\nfunction\n GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n })return HEAPU32}\nfunction\n GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n })return HEAPF64}\nvar Module=typeof\n WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};\nvar\n readyPromiseResolve,readyPromiseReject;Module["ready"]=new\n Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});\nvar\n moduleOverrides={};\nvar key;for(key in\n Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}\nvar arguments_=[];\nvar\n thisProgram=\.this.program\";\nvar quit_=function(status,toThrow){throw\n toThrow};\nvar ENVIRONMENT_IS_WEB=false;\nvar ENVIRONMENT_IS_WORKER=false;\nvar\n ENVIRONMENT_IS_NODE=false;\nvar ENVIRONMENT_IS_SHELL=false;\nENVIRONMENT_IS_WEB=typeof\n window==="object";\nENVIRONMENT_IS_WORKER=typeof\n importScripts==="function";\nENVIRONMENT_IS_NODE=typeof process==="object"&&typeof\n process.versions==="object"&&typeof\n process.versions.node==="string";\nENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM\nENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;\nvar\n ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;\nif(ENVIRONMENT_IS_P\nTHREAD){buffer=Module["buffer"];var scriptDirectory=\"\";\nfunction\n locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}\nreturn\n scriptDirectory+path}\nvar read_,readAsync,readBinary,setWindowTitle;\nvar nodeFS;\nvar\n nodePath;\nif(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").

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dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"\^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=
nodePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"\\")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=="undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=
nodePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]){arguments_=Module["arguments"];}if(Module["thisProgram"]){thisProgram=
Module["thisProgram"];}if(Module["quit"]){quit_=Module["quit"];}function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"]){wasmBinary=Module["wasmBinary"];}var

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noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function
getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new

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Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors
()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDeps
endencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the

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wasm failed"} } catch(err){ abort(err)} } function
getBinaryPromise(){ if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){ if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){ return fetch(wasmBinaryFile,{ credentials:\"same-
origin\"}).then(function(response){ if(!response[\"ok\"]){ throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\" } return
response[\"arrayBuffer\"]()).catch(function(){ return getBinary(wasmBinaryFile)}}) } else { if(readAsync){ return new
Promise(function(resolve,reject){ readAsync(wasmBinaryFile,function(response){ resolve(new
Uint8Array(response)),reject})) } } } return Promise.resolve().then(function(){ return
getBinary(wasmBinaryFile)}) } function createWasm(){ var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){ var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){ var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){ PThread.load
WasmModuleToWorker(w,function(){ if(--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")})) } } if(!ENVIRONMENT_IS_PTHREAD){ addRunDependency(\"wasm-instantiate\") } function
receiveInstantiatedSource(output){ receiveInstance(output[\"instance\"],output[\"module\"])} function
instantiateArrayBuffer(receiver){ return getBinaryPromise().then(function(binary){ return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){ err(\"failed to asynchronously prepare
wasm: \" +reason);abort(reason)}) } function instantiateAsync(){ if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\") { return fetch(wasmBinaryFile,{ credentials:\"same-
origin\"}).then(function(response){ var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){ err(\"wasm streaming compile failed: \" +reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}) } } else { return
instantiateArrayBuffer(receiveInstantiatedSource) } if(Module[\"instantiateWasm\"]){ try { var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports } catch(e) { err(\"Module.instantiateWasm
callback failed with error: \" +e);return false } } instantiateAsync().catch(Promise.reject);return { } } var
ASM_CONSTS={ 10520:function(){ throw\"Canceled!\" },10538:function($0,$1){ setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0}) } };function initPthreadsJS(){ PThread.initRuntime() } function
callRuntimeCallbacks(callbacks){ while(callbacks.length>0){ var callback=callbacks.shift();if(typeof
callback===\"function\") { callback(Module);continue } var func=callback.func;if(typeof
func===\"number\") { if(callback.arg===undefined){ wasmTable.get(func)() } else { wasmTable.get(func)(callback.arg)
} } else { func(callback.arg===undefined?null:callback.arg) } } } var
ERRNO_CODES={ EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENODIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOST
DOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN

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OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.postMessage({\"cmd\": \"cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.pthreads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emsripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emsripten_register_main_browser_thread_id(tb);initWorker:function(){},pthreads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emsripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({\"cmd\": \"exit\"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({\"cmd\": \"cancelDone\"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var

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i=0;i<PThread.runningWorkers.length;++i){ var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){ var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){ var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){ var
thread=PThread pthreads[d.targetThread];if(thread){ thread.worker.postMessage(e.data,d["transferList"]);}else{ con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+'\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d["thread"]);}else
if(cmd===\"killThread\"){killThread(d["thread"]);}else
if(cmd===\"cancelThread\"){cancelThread(d["thread"]);}else
if(cmd===\"loaded\"){ worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{ worker.runPthread();delete
worker.runPthread }else if(cmd===\"print\"){ out(\"Thread \"+d["threadId"]+\": \"+d["text"]);}else
if(cmd===\"printErr\"){ err(\"Thread \"+d["threadId"]+\": \"+d["text"]);}else if(cmd===\"alert\"){ alert(\"Thread
\"+d["threadId"]+\": \"+d["text"]);}else if(cmd===\"exit\"){ var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)} }else
if(cmd===\"exitProcess\"){ try{ exit(d["returnCode"]);}catch(e){ if(e instanceof ExitStatus)return;throw e } }else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){ worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\'+cmd)\"}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\": \"+e.lineno+\":
\'+e.message)};if(ENVIRONMENT_IS_NODE){ worker.on(\"message\",function(data){ worker.onmessage({ data:d
ata})});worker.on(\"error\",function(data){ worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post
Message({\"cmd\":\"load\", \"urlOrBlob\":Module[\"mainScriptUrlOrBlob\"]|_scriptDir,\"wasmMemory\":wasmMe
memory,\"wasmModule\":wasmModule}),allocateUnusedWorker:function(){ var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){ var
t=performance.now()+msecs;while(performance.now()<t){}}};function

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establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function
getNoExitRuntime(){return noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function
invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\": \"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\": \"processThreadQueu
e\"})}else {var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\": \"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atomics.wait returned an unexpected value
\"+ret}else {if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var

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ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){ var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emsripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e

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ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var

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canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ext["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcount){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao){return
ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffersWEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_draw"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault==="undefined"||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents==="object")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("

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EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
__pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)}})f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"\Internal Error! spawnThread()
can only ever be called from main application thread!\";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"\Internal
error!\";if(!threadParams.pthread_ptr)throw"\Internal
error, no pthread ptr!\";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var

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stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread
_ptr };var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":thre
adParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthre
ad=function(){ msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current
environment does not support SharedArrayBuffer, pthreads are not available!\\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\\\"spawnThread\\\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=_pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\\"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\\"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\\");}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread
pointer!\\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()===thread){err(\\"PThread
\\\"+thread+\\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()===thread){err(\\"Main
thread \\\"+thread+\\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread

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\'+thread+\', which does not point to a valid thread, or does not exist anymore!');return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\'Attempted to join thread
\'+thread+\', which was already detached!');return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\'cmd\':\'cleanupThread\',\'thread\':thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\'object\')return
navigator[\'hardwareConcurrency\']||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\'e\':__assert_fail,\'r\':__call_main,\'x\':__emscripten_notify_thread_queue,\'b\':_abort,\'y\':
_emscripten_asm_const_int,\'j\':_emscripten_conditional_set_current_thread_status,\'d\':_emscripten_futex_wait,
\'c\':_emscripten_futex_wake,\'f\':_emscripten_get_now,\'p\':_emscripten_memcpy_big,\'A\':_emscripten_num_l
ogical_cores,\'u\':_emscripten_receive_on_main_thread_js,\'q\':_emscripten_resize_heap,\'v\':_emscripten_set_ca
nvas_element_size,\'i\':_emscripten_set_current_thread_status,\'s\':_emscripten_set_thread_name,\'w\':_emscript
en_webgl_create_context,\'l\':_fd_close,\'n\':_fd_seek,\'g\':_fd_write,\'o\':initPthreadsJS,\'a\':wasmMemory|Mo
dule[\'wasmMemory\'],\'z\':_pthread_cleanup_pop,\'k\':_pthread_cleanup_push,\'h\':_pthread_create,\'m\':_pthr
ead_join,\'t\':_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\'__wasm_call_ctors\']=function(){return(__wasm_call_ctors=Module[\'__wasm
_call_ctors\']=Module[\'asm\']["B"]).apply(null,arguments)};var
_init=Module[\'_init\']=function(){return(_init=Module[\'_init\']=Module[\'asm\']["C"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\'_init_with_threads_count\']=function(){return(_init_with_threads_count=Mod
ule[\'_init_with_threads_count\']=Module[\'asm\']["D"]).apply(null,arguments)};var
_get_threads_count=Module[\'_get_threads_count\']=function(){return(_get_threads_count=Module[\'_get_threads

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_count"]="=Module["asm\"][["E\"]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]="=Module["asm\"][["F\"]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]="=Module["asm\"][["G\"]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]="=Module["asm\"][["H\"]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]="=Module["asm\"][["J\"]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]="=Module["asm\"][["K\"]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]="=Module["asm\"][["L\"]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]="=Module["asm\"][["M\"]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]="=Module["asm\"][["N\"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]="=Module["asm\"][["O\"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]="=Module["asm\"][["P\"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]="=Module["asm\"][["Q\"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]="=Module["asm\"][["R\"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]="=Module["asm\"][["S\"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]="=Module["asm\"][["T\"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]="=Module["asm\"][["U\"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]="=Module["asm\"][["V\"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]="=Module["asm\"][["W\"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]="=Module["asm\"][["X\"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]="=Module["asm\"][["Y\"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]="=Module["asm\"][["Z\"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]="=Module["asm\"][["_\"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]="=Module["asm\"][["$\"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]="=Module["asm\"][["aa\"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]="=Module["asm\"][["ba\"]).apply(null,argument

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s});var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,arguments)};

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ts});var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(n

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ull,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][["_a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["f
b"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["g
b"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["hb"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["as
m"][["mb"]]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]
=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_proc
ess_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_
id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_ems
cripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).app

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ly(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=Module[\"asm\"][\"sb\"]).apply(n
ull,arguments)};var
__emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=function(){retur
n(__emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=Module[\"asm\
\"][\"tb\"]).apply(null,arguments)};var
__emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=function(
){return(__emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=
Module[\"asm\"][\"ub\"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module[\"__emscripten_call_on_thread\"]=function(){return(__emscripten_call_on_t
hread=Module[\"__emscripten_call_on_thread\"]=Module[\"asm\"][\"vb\"]).apply(null,arguments)};var
__emscripten_tls_init=Module[\"_emscripten_tls_init\"]=function(){return(__emscripten_tls_init=Module[\"_emscrip
ten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Mod
ule[\"__emscripten_thread_init\"]=Module[\"asm\"][\"xb\"]).apply(null,arguments)};var
stackSave=Module[\"stackSave\"]=function(){return(stackSave=Module[\"stackSave\"]=Module[\"asm\"][\"yb\"]).a
pply(null,arguments)};var
stackRestore=Module[\"stackRestore\"]=function(){return(stackRestore=Module[\"stackRestore\"]=Module[\"asm\
\"][\"zb\"]).apply(null,arguments)};var
stackAlloc=Module[\"stackAlloc\"]=function(){return(stackAlloc=Module[\"stackAlloc\"]=Module[\"asm\"][\"Ab\
\"]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module[\"_emscripten_stack_set_limits\"]=function(){return(__emscripten_stack_set
limits=Module[\"_emscripten_stack_set_limits\"]=Module[\"asm\"][\"Bb\"]).apply(null,arguments)};var
__memalign=Module[\"_memalign\"]=function(){return(__memalign=Module[\"_memalign\"]=Module[\"asm\"][\"Cb
\"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module[\"__emscripten_allow_main_runtime_queued_calls\"]=1
0512;var
__emscripten_main_thread_futex=Module[\"__emscripten_main_thread_futex\"]=12148;Module[\"cwrap\"]=cwrap
;Module[\"PThread\"]=PThread;Module[\"PThread\"]=PThread;Module[\"wasmMemory\"]=wasmMemory;Module
[\"ExitStatus\"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name=\"ExitStatus\";this.message=\"Program terminated with
exit(\"+status+\")\";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({\"cmd\":\"loaded\"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[\"calledRun\"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\"onRuntimeInitialized\"])Module[\"onRuntimeInitialized\"]();postRun(
)}if(Module[\"setStatus\"]){Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Mo
dule[\"setStatus\"](\"\"),1);doRun()},1)}else{doRun()}}Module[\"run\"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({\"cmd\":\"exitProcess\",\"returnCode\":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module[\"onExit\"])Module[\"onExit\"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[\"preInit\"]){if(typeof
Module[\"preInit\"]==\"function\")Module[\"preInit\"]=[Module[\"preInit\"]];while(Module[\"preInit\"].length>0){

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_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key] }}var
arguments_=[];var thisProgram=\.\/this.program\";var quit_=function(status,toThrow){throw toThrow };var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\/";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"\^"}else{scriptDirectory=__dirname+"\^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=
nodePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^");arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"} }else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data };if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else
if(typeof arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)} }if(typeof print!="undefined"){if(typeof
console==="undefined")console={ };console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print } }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("^")+1)}else{scriptDirectory=\.\/"}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return }onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title } }else{ }var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key

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in

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moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments\"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram\"];if(Module["quit\"])quit_=Module["quit\"];var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary\"];var
noExitRuntime=Module["noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
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Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"]((runDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\"+what+\"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+"\"})return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)}})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)}})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return

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WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\").then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to
ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iow,iocnt,pnum){var num=0;for(var i=0;i<iocnt;i++){var ptr=HEAP32[iow+i*8>>2];var
len=HEAP32[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case

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44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1 }setErrNo(28);return-
1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"B\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"C\"]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"E\"]).apply(null,arguments
)};var
_Cosh=Module[\"_Cosh\"]=function(){return(_Cosh=Module[\"_Cosh\"]=Module[\"asm\"][\"F\"]).apply(null,argu
ments)};var

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_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["V"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["W"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["_"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["ba"]]).apply(null,arguments)};var

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_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var

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_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa\"]]
).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba\"]]
).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca\"]]
).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da\"]]
).apply(null,arguments)
);var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea\"]]
).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa\"]]
).apply(null,arguments)
);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga\"]]
).apply(n
ull,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][["Ha\"]]
).apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia\"]]
).apply(null,argume
nts));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][["Ja\"]]
).apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka\"]]
).apply(null,argument
s));var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La\"]]
).apply(null,argum
ents));var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma\"]]
).apply(null,argumen
ts));var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na\"]]
).apply(null,argu
ments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa\"]]
).apply(null,argumen
ts));var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa\"]]
).apply(null,ar
guments));var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["
Qa\"]]
).apply(null,arguments));var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["R
a\"]]
).apply(null,arguments));var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["Sa\"]]
).apply(null,arguments));var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta\"]]
).apply(nu
ll,arguments));var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua\"]]
).apply(null,argument
s));var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["Va\"]]
).apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa\"]]
).apply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][["Xa\"]]
).apply(null,arguments));var

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stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"])[\"Ya\"
)].apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name=\\\"ExitStatus\\\";this.message=\\\"Program terminated with
exit(\\\"+status+\\\"}\\\";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module[\\\"calledRun\\\"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\\\"onRuntimeInitialized\\\"]Module[\\\"onRuntimeInitialized\\\"]());postRun(
)}if(Module[\\\"setStatus\\\"]){Module[\\\"setStatus\\\"](\\\"Running...\\\");setTimeout(function(){setTimeout(function(){Mo
dule[\\\"setStatus\\\"](\\\"\\\"),1);doRun(),1)}else{doRun()}}Module[\\\"run\\\"]=run;if(Module[\\\"preInit\\\"]){if(typeof
Module[\\\"preInit\\\"]!==\\\"function\\\")Module[\\\"preInit\\\"]=[Module[\\\"preInit\\\"]];while(Module[\\\"preInit\\\"].length>0){
Module[\\\"preInit\\\"].pop()}run();\\n\\n\\n return WasmBackendModule.ready\\n\\n);\\n\\n);\\nif (typeof exports ===
'object' && typeof module === 'object')\\n module.exports = WasmBackendModule;\\nelse if (typeof define ===
'function' && define[\\\"amd\\\"]\\n define([], function() { return WasmBackendModule; });\\nelse if (typeof exports ===
'object')\\n exports[\\\"WasmBackendModule\\\"] = WasmBackendModule;\\n\", /**\\n * @license\\n * Copyright 2019
Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \\\"License\\\");\\n * you
may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an \\\"AS IS\\\" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*/\\nimport './flags_wasm';\\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\\nimport {BackendWasmThreadedSimdModule} from
 './wasm-out/tfjs-backend-wasm-threaded-simd';\\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\\n// @ts-ignore\\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\\n\\ninterface
TensorData {\\n id: number;\\n memoryOffset: number;\\n shape: number[];\\n dtype: DataType;\\n refCount:
number;\\n /** Only used for string tensors, storing encoded bytes. */\\n stringBytes?: Uint8Array[];\\n}\\n\\nexport
type DataId = object; // object instead of {} to force non-primitive.\\n\\nexport class BackendWasm extends
KernelBackend {\\n // 0 is reserved for null data ids.\\n private dataIdNextNumber = 1;\\n dataIdMap:
DataStorage<TensorData>;\\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\\n super();\\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\\n
this.dataIdMap = new DataStorage(this, engine());\\n }\\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\\n DataId {\\n const dataId = {id: this.dataIdNextNumber++};\\n
this.move(dataId, values, shape, dtype, 1);\\n return dataId;\\n }\\n numDataIds(): number {\\n return
this.dataIdMap.numDataIds();\\n }\\n async time(f: () => void): Promise<BackendTimingInfo> {\\n const start =
util.now();\\n f();\\n const kernelMs = util.now() - start;\\n return {kernelMs};\\n }\\n move(\\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\\n dtype: DataType, refCount: number): void {\\n
const id = this.dataIdNextNumber++;\\n if (dtype === 'string') {\\n const stringBytes = values as Uint8Array[];\\n
this.dataIdMap.set(\\n dataId,\\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\\n
return;\\n }\\n const size = util.sizeFromShape(shape);\\n const numBytes = size *
util.bytesPerElement(dtype);\\n const memoryOffset = this.wasm._malloc(numBytes);\\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\\n if (values != null) {\\n this.wasm.HEAPU8.set(\\n new Uint8Array(\\n (values

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as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return\n this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,\n dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return\n stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n * otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\n this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():\n 32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:\n false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this\n * method allocates memory on the WASM heap. If `memoryOffset` is present, the memory was allocated\n * elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:\n number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset\n == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =\n this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:\n TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const\n {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new\n Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,\n size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n function\n createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n };\n }\n\n /**\n * Returns the path of the WASM binary.\n * @param\n * simdSupported whether SIMD is supported\n * @param\n * threadsSupported whether multithreading is supported\n * @param\n * wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null)\n {\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return\n wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&\n threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =\n 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return\n wasmFileMap[path];\n }\n }\n return\n wasmModuleFolder + path;\n }\n\n /**\n * Initializes the wasm\n * module and creates the js <--> wasm bridge.\n * * NOTE: We wrap the wasm module in a object with property\n * 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in

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Chrome 76).\n */\nexport async function init(): Promise<{ wasm: BackendWasmModule}> {\n const
[simdSupported,
 threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], { type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n });\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the ' +\n 'bundled
js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n
 reject({ message: rejectMsg });\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If
`wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported
&& wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob([\n [var
WasmBackendModuleThreadedSimd = ` +\n wasmFactoryThreadedSimd.toString()),\n { type:
'text/javascript'}]);\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory
works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM
module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType:
string = null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n
init: module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count',
null, ['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };\n\n resolve({ wasm: module });\n
 });\n}\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):\n backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const ;\n\ntype WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param

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usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n
*/\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call '+\n
`setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * `js\n * setWasmPaths({\n
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
```\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each
binary (vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM
binaries to custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM
binaries are not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport function setWasmPaths(\n prefixOrFileMap:
string|{[key in WasmBinaryName]?: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n throw
new Error(\n 'The WASM backend was already initialized. Make sure you call '+\n `setWasmPaths()`
before you call `tf.setBackend()` or '+\n `tf.ready()`);\n }\n\n if (typeof prefixOrFileMap === 'string') {\n
wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n
const missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] === null);\n if
(missingPaths.length > 0) {\n throw new Error(\n `There were no entries found for the following binaries: `
+\n ` ${missingPaths.join(',')}. Please either call setWasmPaths with a ` +\n `map providing a path for
each binary, or with a string indicating ` +\n `the directory where all the binaries can be found.);\n }\n }\n\n
customFetch = usePlatformFetch;\n}\n\n/** Used in unit tests. */\nexport function resetWasmPath(): void {\n
wasmPath = null;\n wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted =
false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be
called before calling `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads:
number) {\n threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n *\n * It is set after the backend is intialized.\n */\nexport function getThreadsCount(): number {\n
if (actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return
actualThreadsCount;\n}\n\n","/** @license See the LICENSE file. *\n\n// This code is auto-generated, do not modify
this file!\nconst version = '3.11.0';\nexport {version};\n","/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND,\n * either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *\n *
=====*\n\n*/\n\nimport './flags_wasm';\nimport {registerBackend} from '@tensorflow/tfjs-core';\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n},
WASM_PRIORITY);\n}], "names": ["_FusedMatMul", "util", "Abs", "backend_util", "Add", "AddN", "Identity", "setup",

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"Transpose", "All", "Any", "wasmFunc", "ArgMax", "AvgPool", "Reshape", "BatchMatMul", "slice_util", "buffer", "sliceI
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DBackpropInput", "Cos", "Cosh", "CropAndResize", "Cumsum", "DepthToSpace", "DepthwiseConv2dNative", "Elu", "s
upportsFullBroadcast", "Equal", "Exp", "ExpandDims", "Fill", "FlipLeftRight", "Floor", "FloorDiv", "FusedBatchNorm",
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CvD;MAED,MAAM,QAAQ,GAAG,UAAU,CAAC,EAAE,CAAC;MAC/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACvD,MAAM,QAAQ,GAA G,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,MA AM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,SAAS,CAAC,CAAC;MACpD,MAAM,KAAK,G AAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEnD, MAAM,gBAAgB,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,KAAK,CAAC,KAAK,CAAC,CAAC,MAAM, CAAC,CAAC;MAE5E,iBAAiB,CACb,QAAQ,EAAE,OAAO,EAAE,QAAQ,EAAE,QAAQ,EAAE,gBAAgB,EAA E,UAAU,EACnE,SAAS,EACT,mBAAmB,CAAC,MAAgD,CAAC,EACrE,kBAaKB,EAAE,KAAK,CAAC,CAAC ;MAE/B,IAAI,UAAU,IAAI,IAAI,EAAE;UACtB,OAAO,CAAC,WAAW,CAAC,UAAU,CAAC,MAAM,CAAC,C AAC;OACxC;MAED,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,mBAAmB,GAAiB;MAC/C,UAAU,EA AEA,sBAAa;MACzB,WAAW,EAAE,MAAM;MACnB,SAAS,EAAEvB,OAAK;MACHb,UAAU,EAAE,aAAiC;G AC9C;;ECjGD;,,,,,;,,,,,;EAYBA,IAAI,UACsE,CAAC;EAE3E,SAASA,OAAK,CAAC,OAAoB;MACjC,UAAU,G AAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACwB,eAAM,EAAE,IAAI,aAAa;UACvD,QAAQ;UACR,QAAQ;U ACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAEL,CAAC;WAEe,MAAM,C ACpB,IAAsE;MAEtE,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC, MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;MACnB,MAAM,EAAC,IAAI,EAAE,SAAS,EAAE,OAAO, EAAC,GAAG,KAAK,CAAC;MACzC,MAAM,KAAK,GAAG,CAAC,CAAC,KAAK,CAAC,MAAM,CAAC;MAE 7B9B,aAAI,CAAC,MAAM,CAAC,CAAC,CAAC,KAAK,KAAK,SAAS,IAAI,CAAC,CAAC,KAAK,KAAK,OAA O,EACtD,MAAM,2BAA2B,CAAC,CAAC,KAAK,8BAA8B,CAAC,CAAC;;MAEIE,MAAM,WAAW,GAAGE,q BAAY,CAAC,kBAaKB,CAAC,CAAC,IAAI,CAAC,EAAE,KAAK,CAAC,CAAC;MACnE,IAAI,SAAS,GAAG,C AAC,CAAC;MACIB,IAAI,WAAW,KAAK,IAAI,EAAE;UACxB,SAAS,GAAG,SAAS,CAAC,EAAC,MAAM,EA AE,EAAC,CAAC,EAAC,EAAE,KAAK,EAAE,EAAC,IAAI,EAAE,WAAW,EAAC,EAAE,OAAO,EAAC,CAAC, CAAC;OAC3E;MACD,MAAM,YAAY,GAAGA,qBAAY,CAAC,gBAAgB,CAAC,CAAC,EAAE,KAAK,CAAC,C AAC,CAAC,CAAC,CAAC;MACHeA,qBAAY,CAAC,0BAA0B,CAAC,QAAQ,EAAE,CAAC,YAAY,CAAC,EA AE,KAAK,CAAC,CAAC;MAEzE,MAAM,WAAW,GAAG,OAAO,CAAC,UAAU,CAAC,SAAS,CAAC,KAAK,E AAE,SAAS,CAAC,KAAK,CAAC,CAAC;MACzE,MAAM,QAAQ,GAAG,SAAS,CAAC,KAAK,CAAC,YAAY,C AAC,CAAC;MAC/C,MAAM,WAAW,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,SAAS,CAAC,MAAM, CAAC,CAAC,EAAE,CAAC;MAC/D,MAAM,aAAa,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,WAAW, CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACnE,UAAU,CAAC,WAAW,EAAE,SAAS,GAAG,CAAC,GAAG ,CAAC,EAAE,OAAO,GAAG,CAAC,GAAG,CAAC,EAAE,QAAQ,EACzD,aAAa,EAAE,QAAQ,CAAC,CAAC,C AAC,KAAK,CAAC,CAAC,CAAC;;MAG7C,IAAI,GAAG,GAAG,WAAW,CAAC;MACtB,IAAI,WAAW,KAAK,I AAI,EAAE;UACxB,MAAM,eAAe,GAAGA,qBAAY,CAAC,sBAAsB,CAAC,WAAW,CAAC,CAAC;UACzE,GA AG,GAAG,SAAS,CACb,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,WAAW,EAAC,EAAE,KAAK,EAAE,EAA C,IAAI,EAAE,eAAe,EAAC,EAAE,OAAO,EAAC,CAAC,CAAC;UACvE,OAAO,CAAC,WAAW,CAAC,SAAS,C AAC,MAAM,CAAC,CAAC;UACtC,OAAO,CAAC,WAAW,CAAC,WAAW,CAAC,MAAM,CAAC,CAAC;OACz C;MACD,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,YAAY,GAAiB;MACxC,UAAU,EAAE4B,eAAM; MACIB,WAAW,EAAE,MAAM;MACnB,SAAS,EAAExB,OAAK;MACHb,UAAU,EAAE,MAA0B;GACvC;;ECIF D;,,,,,;,,,,,;EAqBA,IAAI,gBAGuC,CAAC;EAE5C,SAASA,OAAK,CAAC,OAAoB;MACjC,gBAAgB,GAAG,O AAO,CAAC,IAAI,CAAC,KAAK,CAACyB,qBAAY,EAAE,IAAI,WAAW;UACjE,QAAQ;UACR,QAAQ;UACR, QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,C AAC;EAEL,CAAC;WAEe,YAAY,CAAC,IAI5B;MACC,MAAM,EAAC,OAAO,EAAE,MAAM,EAAE,KAAK,E AAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;MACnB,MAAM,EAAC, SAAS,EAAE,UAAU,EAAC,GAAG,KAAK,CAAC;MAEtC,MAAM,SAAS,GAAG,CAAC,CAAC,KAAK,CAAC, CAAC,CAAC,CAAC;MAC7B,MAAM,WAAW,GAAG,CAAC,UAAU,KAAK,MAAM,IAAI,CAAC,CAAC,KAA K,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;MACtE,MAAM,UAAU,GAA G,CAAC,UAAU,KAAK,MAAM,IAAI,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK, CAAC,CAAC,CAAC,CAAC;MACrE,MAAM,UAAU,GAAG,CAAC,UAAU,KAAK,MAAM,IAAI,CAAC,CAAC, KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;MAErE,MAAM,YAAY,

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C,SAAS,EAAE,WAAW,EAAE,YAA Y,EAAE,WAAW,CAAC,CAAC;MAExD,MAAM,GAAG,GAAG,OAAO,C
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E,CAAC;MACrB,MAAM,aAAa,GACf,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC/B,aAAI,CAAC,cAAc,CAAC,CA
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Y,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UACj
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CAAC,MAAM,EAAE,SAAS,EAAE,CAAC,CAAC,CAAC;MACxE,MAAM,gBAAgB,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;MACnC,MAAM,YAAY,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;MAC/B,MAAM,eAAe,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;MACiC,MAAM,aAAa,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;;MAEHc,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,SAAS,CAAC,CAAC;MAC9B,OAAO,EAAc,gBAAgB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAC,CAAC;EACiE;;ECxCA;,,,,,,,,,,,,,;EAuBA,IAAI,UAEuD,CAAC;EA5D,SAASJ,OAAK,CAAC,OAAoB;MACjCI,UAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzBuD,4BAAmB,EACnB,QAAQ;MACR;UACE,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACT,CAAC;EAED,SAAS,UAAU,CAAC,IAInB;MACC,MAAM,EAAc,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAc,YAAY,EAAE,aAAa,EAAE,cAAc,EAAC,GAAG,KAAK,CAAC;MAC5D,MAAM,EAAc,KAAK,EAAE,MAAM,EAAc,GAAG,MAAM,CAAC;MAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACvD,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,MAAM,SAAS,GACxvD,UAAQ,CAAC,OAAO,EAAE,QAAQ,EAAE,aAAa,EAAE,YAAY,EAAE,cAAc,CAAC,CAAC;MAE7E,MAAM,EAAc,gBAAgB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAC,GACiE,iBAAiB,CAAC,OAAO,EAAE,SAAS,CAAC,CAAC;;MAGiC,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,eAAe,CAAC,CAAC;MACpC,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,aAAa,CAAC,CAAC;MAEiC,MAAM,qBAAqB,GACvB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,OAAO,EAAE,gBAAgB,CAAC,CAAC;MAEiE,OAAO,qBAAqB,CAAC;EAC/B,CAAC;EAEM,MAAM,yBAAyB,GAaiB;MACrD,UAAU,EAAEuD,4BAAmB;MAC/B,WAAW,EAAE,MAAM;MACnB,SAAS,EAAE3D,OAAK;MACHb,UAAU,EAAE,UAA8B;GAC3C;;ECzED;,,,,,,,,,,,,,;EAuBA,IAAI,UAGsC,CAAC;EAE3C,SAASJ,OAAK,CAAC,OAAoB;MACjCI,UAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzBwD,4BAAmB,EACnB,QAAQ;MACR;UACE,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,MAAM;OACP,CAAC,CAAC;EACT,CAAC;EAED,SAAS,mBAAmB,CAAC,IAI5B;MACC,MAAM,EAAc,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAc,YAAY,EAAE,aAAa,EAAE,cAAc,EAAE,kBAakB,EAAC,GACnE,KAAK,CAAC;MACv,MAAM,EAAc,KAAK,EAAE,MAAM,EAAc,GAAG,MAAM,CAAC;MAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACvD,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,MAAM,SAAS,GAAGxD,UAAQ,CACtB,OAAO,EAAE,QAAQ,EAAE,aAAa,EAAE,YAAY,EAAE,cAAc,EAAC9D,kBAakB,CAAC,CAAC;MAExB,MAAM,EAAc,gBAAgB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAC,GACiE,iBAAiB,CAAC,OAAO,EAAE,SAAS,CAAC,CAAC;;MAGiC,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,eAAe,CAAC,CAAC;MAEpC,MAAM,qBAAqB,GACvB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,OAAO,EAAE,gBAAgB,CAAC,CAAC;MAEiE,MAAM,kBAakB,GAAG,OAAO,CAAC,UAAU,CAAC,EAAE,EAAE,OAAO,EAAE,aAAa,CAAC,CAAC;MAEiE,OAAO,CAAC,qBAAqB,EAAE,kBAakB,CAAC,CAAC;EACrD,CAAC;EAEM,MAAM,yBAAyB,GAaiB;MACrD,UAAU,EAAEwD,4BAAmB;MAC/B,WAAW,EAAE,MAAM;MACnB,SAAS,EAAE5D,OAAK;MACHb,UAAU,EAAE,mBAAuC;GACpD;;EC9ED;,,,,,,,,,,,,,;EAuBA,IAAI,UAGU,CAAC;EAef,SAASJ,OAAK,CAAC,OAAoB;MACjCI,UAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzByD,4BAAmB,EACnB,QAAQ;MACR;UACE,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACT,CAAC;EAED,SAAS,YAAU,CAAC,IAInB;MACC,MAAM,EAAc,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAc,YAAY,EAAE,aAAa,EAAE,cAAc,EAAE,YAAY,EAAC,GAAG,KAAK,CAAC;MACiE,MAAM,EAAc,KAAK,EAAE,MAAM,EAAc,GAAG,MAAM,CAAC;MAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACvD,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,MAAM,SAAS,GAAGiD,UAAQ,CACtB,OAAO,EAAE,QAAQ,EAAE,aAAa,EAAE,YAAY,EAAE,cAAc,EAC9D,YAAY,CAAC,CAAC;MAEiB,MAAM,EAAc,gBAAgB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAC,GACiE,iBAAiB,CAAC,OAAO,EAAE,SAAS,CAAC,CAAC;;MAiC,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,aAAa,CAAC,CAAC;MAEiC,MAAM,qBAAqB,GACvB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,OAAO,EAAE,gBAAgB,CAAC,CAAC;MACiE,MAAM,oBAAoB,GACtB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,SAAS,EAAE,eAAe,CAAC

,CAAC;MAEnE,OAAO,CAAC,qBAaQb,EAAE,oBAAoB,CAAC,CAAC;EACvD,CAAC;EAEM,MAAM,yBAAy B,GAAiB;MACrD,UAAU,EAAEyD,4BAaMB;MAC/B,WAaw,EAAE,MAAM;MACnB,SAAS,EAAE7D,OAAK; MACHb,UAAU,EAAE8D,YAA8B;GAC3C;;EC9ED;;;;;;;;;;;;;;;;EAmBA,MAAMIC,uBAaQb,GAAG,KAAK,CAA C;EAC7B,MAAM,cAAc,GACvB,wBAawB,CAACmC,iBAaQ,EAAEnC,uBAaQb,EAAE,MAAM,CAAC;;ECrBr E;;;;;;;;;;;;;;EaqBA,IAAI,UAesB,CAAC;EAE3B,SAAS5B,OAAK,CAAC,OAAoB;MACjC,UAAU,GAAG,OAA O,CAAC,IAAI,CAAC,KAAK,CAACgE,eAAM,EAAE,IAAI,aAAa;UACvD,QAAQ;UACR,QAAQ;UACR,QAAQ; UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAcl,CAAC;EAED,SAAS,MAAM,CACX,IAAsE;MACxE, MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAC,OAAO, EAAC,GAAG,MAAM,CAAC;MACzB,MAAM,EAAC,KAAK,EAAE,OAAO,EAAE,QAAQ,EAAC,GAAG,KAA K,CAAC;MAEzC,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,GAAG,OAAO,CAAC,KAAK,EA AE,KAAK,CAAC,EAAE,OAAO,CAAC,CAAC;MACnE,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GA AG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEnD,MAAM,WAaw,GAAG,OAAO,CAAC, SAAS,CAAC,GAAG,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC;MAC1D,MAAM,SAAS,GAAG,WAaw,CAA C,EAAE,CAAC;MAEjC,UAAU,CAAC,SAAS,EAAE,KAAK,EAAE,OAAO,EAAE,QAAQ,EAAE,KAAK,CAAC, CAAC;MAEvD,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,YAAY,GAAiB;MACxC,UAAU,EAAEA,eA AM;MACIB,WAaw,EAAE,MAAM;MACnB,SAAS,EAAEH,e,OAAK;MACHb,UAAU,EAAE,MAA0B;GACvC;; ECzDD;;;;;;;;;;;;;;EaqBA,SAAS,QAAQ,CAAC,IAAoD;MACpE,MAAM,EAAC,MAAM,EAAE,EAAC,CAAC,E AAC,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;MACpC,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,C AAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;MACjD,MAAM,OAAO,GAAG,OAAO,CAAC,k BAakB,CAAC,GAAG,CAAC,CAAC;MACHd,OAAO,CAAC,IAAI,CAAC,CAAC,CAAC,CAAC;MACHb,OAAO ,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,cAAc,GAAiB;MAC1C,UAAU,EAAEiE,iBAaQ;MACpB,WAaw,E AAE,MAAM;MACnB,UAAU,EAAE,QAA4B;GACzC;;ECjCD;;;;;;;;;;;;;;;WAuBgB,IAAI,CACHb,IAAkE;MAEp E,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAC,IAAI, EAAC,GAAG,KAAK,CAAC;MAErB,IAAI,MAAM,CAAC,MAAM,KAAK,CAAC,EAAE;UACvB,OAAO,UAAU ,CACb,EAAC,MAAM,EAAE,EAAC,KAAK,EAAE,MAAM,CAAC,CAAC,CAAC,EAAC,EAAE,OAAO,EAAE,K AAK,EAAE,EAAC,GAAG,EAAE,IAAI,EAAC,EAAC,CAAC,CAAC;OACHE;MAED,MAAM,KAAK,GAAG,MA AM,CAAC,CAAC,CAAC,CAAC,KAAK,CAAC;MAC9B,MAAM,KAAK,GAAG,MAAM,CAAC,CAAC,CAAC, CAAC,KAAK,CAAC;MAE9B,MAAM,CAAC,OAAO,CAAC,CAAC;UACdvE,aAAI,CAAC,iBAaiB,CACIB,KA AK,EAAE,CAAC,CAAC,KAAK,EACd,uDAauD,CAAC,CAAC;UAC7DA,aAAI,CAAC,MAAM,CACP,KAAK,K AAK,CAAC,CAAC,KAAK,EACjB,MAAM,uDAauD,CAAC,CAAC;OACpE,CAAC,CAAC;MAEH,MAAM,uBA AuB,GAAiB,EAAE,CAAC;MACjD,MAAM,eAAe,GAAG,MAAM,CAAC,GAAG,CAAC,CAAC;UACIC,MAAM, SAAS,GACX,UAAU,CAAC,EAAC,MAAM,EAAE,EAAC,KAAK,EAAE,CAAC,EAAC,EAAE,OAAO,EAAE,K AAK,EAAE,EAAC,GAAG,EAAE,IAAI,EAAC,EAAC,CAAC,CAAC;UACIE,uBAauB,CAAC,IAAI,CAAC,SAAS,CAAC,CAAC;UACxC,OAAO,SAAS,CAAC;OACIB,CAAC,CAAC;MAEH,MAAM,MAAM,GAAG,MAAM,C AAC,EAAC,MAAM,EAAE,eAAe,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,IAAI,EAAC,EAAC,CAAC,CAAC; MAEzE,uBAauB,CAAC,OAAO,CAAC,CAAC,IAAI,OAAO,CAAC,WAaw,CAAC,CAAC,CAAC,MAAM,CAA C,CAAC,CAAC;MAEpE,OAAO,MAAM,CAAC;EACHb,CAAC;EAEM,MAAM,UAAU,GAAiB;MACtC,UAAU, EAAEW,eAAI;MACHb,WAaw,EAAE,MAAM;MACnB,UAAU,EAAE,IAAwB;GACrC;;ECjED;;;;;;;;;;;;;;Eay BA,IAAI,SAG6C,CAAC;EAEID,SAASIE,OAAK,CAAC,OAAoB;MACjC,SAAS,GAAG,OAAO,CAAC,IAAI,CAA C,KAAK,CAACmE,cAAK,EAAE,IAAI,aAAa;UACrD,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,QAAQ;UA CR,OAAO;UACP,OAAO;UACP,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAcl,CAAC;EAED,SAAS,GAAG ,CACR,IAAoE;MACtE,MAAM,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE, EAAC,QAAQ,EAAE,aAAa,EAAC,EAAC,GAAG,IAAI,CAAC;MAEtE,MAAM,QAAQ,GAAG,QAAQ,CAAC,G AAG,CACzB,CAAC,CAAC,EAAE,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC,mBAaMB,CAAC,CAAC,KAAK ,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,CAAC,CAAC,gBAagB,CAAC;MAEvE,IAAIzE,aAAI,CAAC,aAAa, CAAC,CAAC,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;;;UAGrC,OAAO,IAAI,CAAC;cACV,OAAO;cACP,K AAK,EAAE,EAAC,KAAK,EAAE,QAAQ,EAAE,KAAK,EAAE,aAAa,EAAE,KAAK,EAAE,CAAC,CAAC,KAA K,EAAC;WAC/D,CAAC,CAAC;OACJ;MAED,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAA

C,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;MACID,MAAM,aAAa,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC;MACxD,MAAM,KAAK,GAAG,aAAa,CAAC,EAAE,CAAC;MAE/B,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;MAEnE,MAAM,eAAe,GAAG,QAAQ,CAAC,GAAG,CAAC,QAAQ,IAAI,QAAQ,CAAC,CAAC,CAAC,CAAC;MAC9D,MAAM,gBAAgB,GAAG,QAAQ,CAAC,GAAG,CAAC,QAAQ,IAAI,QAAQ,CAAC,CAAC,CAAC,CAAC,CAAC;MAC/D,MAAM,gBAAgB,GACIB,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,eAAe,CAAC,CAAC,MAAM,CAAC,CAAC;MAC3D,MAAM,iBAAiB,GACnB,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,gBAAgB,CAAC,CAAC,MAAM,CAAC,CAAC;MAE5D,SAAS,CACL,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE,gBAAgB,EACrE,iBAAiB,EAAE,aAAa,EAAE,KAAK,CAAC,CAAC;MAC7C,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,WAAW,GAAiB;MACvC,UAAU,EAAEyE,cAAK;MACjB,WAAW,EAAE,MAAM;MACnB,UAAU,EAAE,GAuB;MACnC,SAAS,EAAEnE,OAAK;GACjB;;ECpFD;;;;;;;EAmBA,MAAM4B,uBAAqB,GAAG,KAAK,CAAC;EAC7B,MAAM,SAAS,GACIB,wBAAwB,CAACwC,YAAG,EAAExC,uBAAqB,CAAC;;ECrBxD;;;;;;;EABuBA,IAAI,SAaKE,CAAC;EAEvE,SAAS5B,OAAK,CAAC,OAAoB;MACjC,SAAS,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACqE,cAAK,EAAE,IAAI,aAAa;UACrD,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAEL,CAAC;EAED,SAAS,KAAK,CAAC,IAAiD;MAC9D,MAAM,EAAC,MAAM,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;MAC/B,MAAM,EAAC,CAAC,EAAE,KAAK,EAAC,GAAG,MAAM,CAAC;MACIB,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,MAAM,SAAS,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEZD,IAAI,OAAO,GAAG,GAAG,CAAC;MACIB,MAAM,KAAK,GAAG,CAAC,CAAC;MACHB,IAAI,WAAW,GAAG,KAAK,CAAC;MACxB,IAAI,KAAK,CAAC,KAAK,KAAK,SAAS,EAAE;UAC7B,WAAW,GAAG,IAAI,CAAC,EAAC,OAAO,EAAE,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,SAAS,EAAC,EAAC,CAAC,CAAC;UACtE,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,WAAW,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;OACxD;MAED,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,SAAS,CAAC,CAAC;MACnD,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACnD,SAAS,CAAC,OAAO,EAAE,SAAS,EAAE,KAAK,CAAC,CAAC;MAErC,IAAI,KAAK,CAAC,KAAK,KAAK,SAAS,EAAE;UAC7B,OAAO,CAAC,WAAW,CAAC,WAAW,CAAC,MAAM,CAAC,CAAC;OACzC;MACD,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,WAAW,GAAiB;MACvC,UAAU,EAAEA,cAAK;MACjB,WAAW,EAAE,MAAM;MACnB,SAAS,EAAErE,OAAK;MACHB,UAAU,EAAE,KAAyB;GACtC;;EC9DD;;;;;;;EAYBA,IAAI,QAEqC,CAAC;EAEIC,SAASA,OAAK,CAAC,OAAoB;MACjC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACsE,aAAI,EAAE,IAAI,WAAW;UACjD,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EAEL,CAAC;EAED,SAAS,IAAI,CAAC,IAIb;MACC,MAAM,EAAC,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAC,IAAI,EAAE,QAAQ,EAAC,GAAG,KAAK,CAAC;MAC/B,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;MACnB,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,IAAI,OAAO,GAAG,GAAG,CAAC;MACIB,IAAI,KAAK,GAAG,CAAC,CAAC;MAEd,MAAM,EAAC,UAAU,EAAE,IAAI,EAAE,YAAY,EAAE,kBAakB,EAAC,GACtD,uBAAuB,CAAC,CAAC,EAAE,IAAI,EAAE,OAAO,CAAC,CAAC;MAE9C,IAAI,aAAa,GAAG,IAAI,CAAC;MACzB,IAAI,kBAakB,EAAE;UACtB,MAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UACjE,IAAI,YAAY,KAAK,GAAG,EAAE;;;cAGxB,KAAK,GAAG,UAAU,CAAC;cACnB,OAAO,GAAG,YAAY,CAAC;cACvB,aAAa,GAAGIE,qBAAY,CAAC,gBAAgB,CACzC,aAAa,CAAC,MAAM,EAAE,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;WAC/C;OACF;MAEDA,qBAAY,CAAC,0BAA0B,CACnC,MAAM,EAAE,aAAa,EAAE,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;MAC/C,MAAM,CAAC,QAAQ,EAAE,WAAW,CAAC,GACzBA,qBAAY,CAAC,yBAAYB,CAAC,KAAK,CAAC,KAAK,EAAE,aAAa,CAAC,CAAC;MACvE,MAAM,UAAU,GAAGF,aAAI,CAAC,aAAa,CAAC,WAAW,CAAC,CAAC;MAEnD,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,KAAK,CAAC,KAAK,CAAC,CAAC;MACtD,IAAIA,aAAI,CAAC,aAAa,CAAC,KAAK,CAAC,KAAK,CAAC,KAAK,CAAC,EA

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,UAAU,CAAC,MAAM,CAAC,CAAC;OACxC;MAED,IAAI,QAAQ,EAAE;;UAEZ,MAAM,QAAQ,GAAGE,qBA
AY,CAAC,oBAAoB,CAAC,GAAG,CAAC,KAAK,EAAE,YAAY,CAAC,CAAC;UAC5E,GAAG,CAAC,KAAK,G
AAG,QAAQ,CAAC;OACtB;MAED,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,UAAU,GAAiB;MACtC
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```
=====\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmProd: (\n  xId: number, reduceSize: number,\n  dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n    'number',\n    'number',\n    'number',\n    'number'\n  ]);\n\n  function prod(args: {\n    backend: BackendWasm,\n    inputs: ProdInputs,\n    attrs: ProdAttrs\n  }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =\n        backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We\n        // will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n      }\n      reductionAxes = backend_util.getInnerMostAxes(\n        reductionAxes.length, input.shape.length);\n    }\n\n    backend_util.assertAxesAreInnerMostDims(\n      'prod', reductionAxes, input.shape.length);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize =\n      util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n    if (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmProd(inputId, reduceSize, CCppType[out.dtype], outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape =\n        backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\n  export const prodConfig: KernelConfig = {\n    kernelName: Prod,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: prod as {} as KernelFunc\n  };
}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prod.js.map

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```

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*  
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Mean.d.ts  
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OneHot.js  
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.d.ts  
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No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet wasmFusedConv2d:\n  (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n   filterId: number, filterHeight: number, filterWidth: number,\n   biasId: number, padTop: number, padRight: number, padBottom: number,\n   padLeft: number, isSamePad: number, dilationHeight: number,\n   dilationWidth: number, strideHeight: number, strideWidth: number,\n   inputChannels: number, outputChannels: number, activation: number,\n   preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n   void;\n\nfunction\n  setup(backend: BackendWasm) {\n    wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n      'number', // xId\n      'number', // batchSize\n      'number', // inputHeight\n      'number', // inputWidth\n      'number', // filterId\n      'number', // filterHeight\n      'number', // filterWidth\n      'number', // biasId\n      'number', // padTop\n      'number', // padRight\n      'number', // padBottom\n      'number', // padLeft\n      'number', // isSamePad\n      'number', // dilationHeight\n      'number', // dilationWidth\n      'number', // strideHeight\n      'number', // strideWidth\n      'number', // inputChannels\n      'number', // outputChannels\n      'number', // activation\n      'number', // preluActivationWeightsId\n      'number', // leakyreluAlpha\n      'number', // outId\n    ]);\n\n    fusedConv2d(args: {\n      inputs: FusedConv2DInputs,\n      backend: BackendWasm,\n      attrs: FusedConv2DAttrs\n    }) {\n      const { inputs, attrs, backend } = args;\n      const { x, filter, bias, preluActivationWeights } = inputs;\n      const {\n        strides,\n        pad,\n        dilations,\n        dataFormat,\n        dimRoundingMode,\n        activation,\n        leakyreluAlpha\n      } = attrs;\n\n      const convInfo = backend_util.computeConv2DInfo(\n        (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n        pad, dimRoundingMode);\n\n      const fusedActivation =\n        FusibleActivation[activation as {}] as keyof typeof\n        FusibleActivation;\n      if (fusedActivation == null) {\n        throw new Error(\n          `${activation} activation not yet supported for FusedConv2D` +\n          ` in the wasm backend.`);\n      }\n\n      const xId = backend.dataIdMap.get(x.dataId).id;\n      const filterId = backend.dataIdMap.get(filter.dataId).id;\n      const outputChannels = convInfo.outChannels;\n\n      let biasId = 0;\n      if (bias != null) {\n        const biasData = backend.dataIdMap.get(bias.dataId);\n        if (biasData.shape.length !== 1) {\n          throw new Error(\n
```

```

`FusedConv2D only supports rank-1 bias but
got ` +\n      `rank ${biasData.shape.length}.`);\n  }\n  if (biasData.shape[0] !== outputChannels) {\n    throw
new Error(\n      `FusedConv2D bias shape (${biasData.shape}) does not ` +\n      `match the number of output
channels (${outputChannels})`);\n  }\n  biasId = biasData.id;\n  }\n\n  const filterHeight =
convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const
padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft =
convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n  const batchSize = convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const
inWidth = convInfo.inWidth;\n\n  if (dataFormat !== 'NHWC') {\n    throw new Error(\n      `wasm backend FusedConv2D does not support
dataFormat:` +\n      `${dataFormat}`. Please use 'NHWC'.`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const
preluActivationWeightsId = preluActivationWeights === null ?\n    0 :\n  backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n  wasmFusedConv2d(\n    xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n    fusedActivation,\n    preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n  return out;\n}\n\n\nexport const fusedConv2DConfig:
KernelConfig = {\n  kernelName: FusedConv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n"}

```

Found in path(s):

*

/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n
*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTile: (n  xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n    'number', // x_id\n    'array', // x_shape\n    'number', // x_shape.length\n    'array', // new_shape\n    'number', // new_shape.length\n    'number' // out_id\n  ]);\n\n  function tile(\n    args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const {reps} = attrs;\n\n    const newShape: number[] = new Array(x.shape.length);\n    for (let i = 0; i < newShape.length; i++) {\n      newShape[i] = x.shape[i] * reps[i];\n    }\n\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n    const out = backend.makeOutput(newShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmTile(\n      xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n      CCppType[out.dtype], outId);\n    return out;\n  }\n\n  export const tileConfig: KernelConfig = {\n    kernelName: Tile,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: tile as { } as KernelFunc\n  };
}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.js.map

No license file was found, but licenses were detected in source scan.

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```

```
=====\n
*\n\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\n  createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');
}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Equal.js.map

No license file was found, but licenses were detected in source scan.

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"sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under
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License.\n
* =====\n
*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Ceil.js.map

No license file was found, but licenses were detected in source scan.

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"sourcesContent":["/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law
or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\nimport './flags_wasm';\nimport {registerBackend} from '@tensorflow/tfjs-core';\nimport {BackendWasm,
init} from './backend_wasm';\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\nexport {version as version_wasm} from './version';\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n  const {wasm} = await init();\n  return new
BackendWasm(wasm);\n}, WASM_PRIORITY);\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/base.js.map

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```
=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { transpose } from './Transpose';\n\n * Compute permutation axes and do a transpose if necessary.\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,\n  axis: number|number[], backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes: number[],\n  inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n  const originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes = backend_util.getAxesPermutation(axes,\n    xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if (permutedAxes !== null) {\n    const newShape: number[] = new Array(xRank);\n    for (let i = 0; i < newShape.length; i++) {\n      newShape[i] = xShape[permutedAxes[i]];\n    }\n    axes = backend_util.getInnerMostAxes(axes.length, xRank);\n    xTransposed =\n      transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n    if (transposedId !== xId) {\n      inputWasTransposed = true;\n    }\n  }\n  return {transposed: xTransposed,\n    originalAxes, axes, inputWasTransposed};\n}\n\n}}
```

Found in path(s):

*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.js.map

No license file was found, but licenses were detected in source scan.

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```

C,MAAM,eAAe,GACxB,wBAAwB,CAAC,SAAS,EAAE,qBAAqB,EAAE,MAAM,CAAC,CAAC", "sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.js.map

No license file was found, but licenses were detected in source scan.

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```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nlet wasmPrelu: (xId: number,
```

```

weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n  'number', // x_id\n  'number', // weights_id\n  'number' //
out_id\n  ]);\n}\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n  const {inputs, backend}
= args;\n  const {x, alpha} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n  let inputId = xId;\n  const input = x;\n  let castedInput = input;\n  if (input.dtype !== 'float32') {\n    castedInput =
cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n    inputId = backend.dataIdMap.get(castedInput.dataId).id;\n  }\n\n  const out = backend.makeOutput(x.shape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  wasmPrelu(inputId, weightsId, outId);\n\n  if (input.dtype !== 'float32') {\n    backend.disposeData(castedInput.dataId);\n  }\n  return out;\n}\n\nexport const preluConfig: KernelConfig = {\n  kernelName: Prelu,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: prelu as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Prelu.js.map

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specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
=\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```

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```

***** */
/**
* @deprecated Use `setWasmPaths` instead.
* Sets the path to the `.wasm` file which will be fetched when the wasm
* backend is initialized. See
* https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
* for more details.
* @param path wasm file path or url
* @param
  usePlatformFetch optional boolean to use platform fetch to download
  the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
*/

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/miniprogram/index.js

```

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11\n ])));\n\n/**\n * True if threads are supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT',\n async () => {\n // TODO(annxingyuan): Enable node support once this is resolved:\n // https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n // Test for transferability of SABs (needed for Firefox)\n // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11\n ]));\n } catch (e) {\n return false;\n }\n });\n\n"]}
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Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/flags_wasm.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize: number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // outer_size\n    'number', // inner_size\n    'number' // out_id\n  ]);\n\n  function argmax(\n    args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n    const { backend, inputs, attrs } = args;\n    const { axis } = attrs as {} as ArgMaxAttrs;\n    const { x } = inputs as {} as ArgMaxInputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n      }\n\n      const outShape = input.shape.slice(0, -1);\n      const out = backend.makeOutput(outShape, 'int32');\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      const outerSize = util.sizeFromShape(out.shape);\n      const innerSize = input.shape[axes[0]];\n      wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n      if (inputWasTransposed) {\n        // dispose of the transposed tensor.\n        backend.disposeData(transposed.dataId);\n      }\n\n      return out;\n    }\n\n    export const argMaxConfig: KernelConfig = {\n      kernelName: ArgMax,\n      backendName: 'wasm',\n      kernelFunc: argmax as {} as KernelFunc,\n      setupFunc: setup\n    };
  }\n}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ArgMax.js.map

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```
=====
*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
  KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
  filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n  outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
  topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n  xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride:
  number, yColStride: number,\n  yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n
  'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n
'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n
'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n
'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', //
yChannelStride\n 'number', // outId\n ]);\n\nfunction conv2DBackpropInput(args: {\n  backend:
BackendWasm,\n  inputs: Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const { backend, inputs, attrs } = args;\n  const { dy, filter } = inputs;\n  const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\n\n  const dilations = 1;\n\n  const $dataFormat
= backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
  inputShape, filter.shape as [number, number, number, number], strides,\n  dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n  const {\n    batchSize,\n    filterHeight,\n    filterWidth,\n    inChannels,\n
inHeight,\n    inWidth,\n    outChannels,\n    outHeight,\n    outWidth,\n    strideHeight,\n    strideWidth\n  } =
convInfo;\n\n  const topPad = filterHeight - 1 - convInfo.padInfo.top;\n  const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n  const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n  const dxStrides =
util.computeStrides(convInfo.inShape);\n  const dyStrides = util.computeStrides(dy.shape);\n  const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n  const xBatchStride = dxStrides[0];\n  const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n  const xColStride = isChannelsLast ? dxStrides[2]
: 1;\n  const xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n  const yBatchStride = dyStrides[0];\n  const
yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];\n  const yColStride = isChannelsLast ? dyStrides[2] :
1;\n  const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n  const out =
backend.makeOutput(convInfo.inShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const
dyId = backend.dataIdMap.get(dy.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n    dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n    inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n    topPad, leftPad, fltS0, fltS1, fltS2,
xBatchStride, xRowStride,\n    xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n  return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n
  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n}}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

wasm/dist/kernels/Conv2DBackpropInput.js.map
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 * =====
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1.236 @tensorflow/tfjs-backend-webgl 3.11.0

1.236.1 Available under license :

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1.237 @tensorflow/tfjs-backend-cpu 3.11.0

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 * =====
```

1.238 @tensorflow-models/body-pix 2.2

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 */
```

Found in path(s):

- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.min.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.esm.js

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 */
```

Found in path(s):

- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/keypoints.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_pose.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/blur.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/decode_part_map.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/decode_single_pose.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/build_part_with_score_queue.d.ts

```
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.d.ts
*
```

```
/opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/build_part_with_score_queue.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_pose.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/blur.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/keypoints.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/decode_part_map.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/run_tests.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/decode_single_pose.js
```

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```
{"version":3,"file":"body-pix.min.js","sources":["../src/decode_part_map.ts","../src/base_model.ts","../src/mobilenet.ts","../src/keypoints.ts","../src/multi_person/util.ts","../src/multi_person/decode_multiple_masks_cpu.ts","../src/multi_person/decode_multiple_masks_webgl.ts","../src/multi_person/decode_instance_masks.ts","../src/multi_person/max_heap.ts","../src/multi_person/build_part_with_score_queue.ts","../src/multi_person/decode_pose.ts","../src/multi_person/decode_multiple_poses.ts","../src/resnet.ts","../src/saved_models.ts","../src/util.ts","../src/body_pix_model.ts","../src/output_rendering_util.ts","../src/blur.ts","../src/part_channels.ts","../src/version.ts"],"sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport * as tf from '@tensorflow/tfjs-core';\n\n/**\n * Takes the sigmoid of the part heatmap output and generates a 2d one-hot\n * tensor with ones where the part's score has the maximum value.\n * @param partHeatmapScores\n * @function toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n
```

```

const numParts = partHeatmapScores.shape[2];
const partMapLocations = tf.argmax(partHeatmapScores, 2);
const partMapFlattened = tf.reshape(partMapLocations, [-1]);
return tf.oneHot(partMapFlattened, numParts) as tf.Tensor2D;
function clipByMask2d(image: tf.Tensor2D, mask: tf.Tensor2D): tf.Tensor2D {
return tf.mul(image, mask);
}

```

* Takes the sigmoid of the segmentation output, and generates a segmentation mask with a 1 or 0 at each pixel where there is a person or not a person. The threshold determines the threshold of a score for a pixel for it to be considered part of a person.

 @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.

 @param segmentationThreshold The minimum that segmentation values must have to be considered part of the person. Affects the generation of the segmentation mask and the clipping of the colored part image.

 @returns A segmentation mask with a 1 or 0 at each pixel where there is a person or not a person.

 ^export function toMaskTensor(segmentScores: tf.Tensor2D, threshold: number): tf.Tensor2D {

```

return tf.tidy(() => (
    tf.cast(tf.greater(segmentScores, tf.scalar(threshold)), 'int32') as tf.Tensor2D));
}

```

Takes the sigmoid of the person and part map output, and returns a 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped by the segmentation mask. Wherever the a pixel is clipped by the segmentation mask, its value will set to -1, indicating that there is no part in that pixel.

 @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.

 @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap output. The third dimension corresponds to the part.

 @returns A 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped by the segmentation mask. It will have values of -1 for pixels that are outside of the body and do not have

 a corresponding part.

 ^export function decodePartSegmentation(segmentationMask: tf.Tensor2D, partHeatmapScores: tf.Tensor3D): tf.Tensor2D {

```

const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
return tf.tidy(() => {
const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
const partMapFlattened = tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);
const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));
return tf.sub(clipByMask2d(partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask), tf.scalar(1, 'int32'));
});
}

```

^export function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
return tf.tidy(() => {
const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
const partMapFlattened = tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
return tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);
});
});

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 *

```

=====
^import * as tfconv from '@tensorflow/tfjs-converter';
^import * as tf from '@tensorflow/tfjs-core';
^import {BodyPixOutputStride} from './types';

```

* BodyPix supports using various convolution neural network models (e.g. ResNet and MobileNetV1) as its underlying base model. The following BaseModel interface defines a unified interface for creating such BodyPix base models. Currently both MobileNet (in ./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel interface. New base models that conform to the BaseModel interface can be added to BodyPix.

 ^export abstract class BaseModel {
constructor(

```

protected readonly model: tfconv.GraphModel,\n    public readonly outputStride: BodyPixOutputStride) {\n
const inputShape =\n    this.model.inputs[0].shape as [number, number, number, number];\n    tf.util.assert(\n        (inputShape[1] === -1) && (inputShape[2] === -1),\n        () => `Input shape [${inputShape[1]},\n    ${inputShape[2]}]` +\n        `must both be equal to or -1`);\n    }\n\n    abstract preprocessInput(input: tf.Tensor3D):\n    tf.Tensor3D;\n\n    /**\n     * Predicts intermediate Tensor representations.\n     *\n     * @param input The input RGB\n     image of the base model.\n     * A Tensor of shape: [`inputResolution`, `inputResolution`, 3].\n     *\n     * @return A\n     dictionary of base model's intermediate predictions.\n     * The returned dictionary should contains the following\n     elements:\n     * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.\n     * - offsets: A\n     Tensor3D that represents the offsets.\n     * - displacementFwd: A Tensor3D that represents the forward\n     displacement.\n     * - displacementBwd: A Tensor3D that represents the backward displacement.\n     * -\n     segmentation: A Tensor3D that represents the segmentation of all\n     * people.\n     * - longOffsets: A Tensor3D\n     that represents the long offsets used for\n     * instance grouping.\n     * - partHeatmaps: A Tensor3D that represents\n     the body part segmentation.\n     */\n    predict(input: tf.Tensor3D): {\n        heatmapScores: tf.Tensor3D,\n        offsets:\n        tf.Tensor3D,\n        displacementFwd: tf.Tensor3D,\n        displacementBwd: tf.Tensor3D,\n        segmentation:\n        tf.Tensor3D,\n        partHeatmaps: tf.Tensor3D,\n        longOffsets: tf.Tensor3D,\n        partOffsets: tf.Tensor3D\n    } {\n    return tf.tidy(() => {\n        const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n        const asBatch =\n        tf.expandDims(asFloat, 0);\n        const results = this.model.predict(asBatch) as tf.Tensor4D[];\n        const results3d:\n        tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n        const namedResults =\n        this.nameOutputResults(results3d);\n\n        return {\n            heatmapScores: tf.sigmoid(namedResults.heatmap),\n            offsets: namedResults.offsets,\n            displacementFwd: namedResults.displacementFwd,\n            displacementBwd:\n            namedResults.displacementBwd,\n            segmentation: namedResults.segmentation,\n            partHeatmaps:\n            namedResults.partHeatmaps,\n            longOffsets: namedResults.longOffsets,\n            partOffsets:\n            namedResults.partOffsets\n        };\n    });\n\n    // Because MobileNet and ResNet predict() methods output a\n    different order for\n    // these values, we have a method that needs to be implemented to order them.\n    abstract\n    nameOutputResults(results: tf.Tensor3D[]): {\n        heatmap: tf.Tensor3D,\n        offsets: tf.Tensor3D,\n        displacementFwd: tf.Tensor3D,\n        displacementBwd: tf.Tensor3D,\n        segmentation: tf.Tensor3D,\n        partHeatmaps: tf.Tensor3D,\n        longOffsets: tf.Tensor3D,\n        partOffsets: tf.Tensor3D\n    };}\n\n    /**\n     * Releases\n     the CPU and GPU memory allocated by the model.\n     */\n    dispose() {\n        this.model.dispose();\n    }\n\n    /**\n     *\n     @license\n     * Copyright 2019 Google Inc. 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```

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```
=====
*/
export type Tuple<T> = [T, T];
export type StringTuple = Tuple<string>;
export type NumberTuple = Tuple<number>;
export const PART_NAMES = [
  'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',
  'leftShoulder', 'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',
  'leftHip', 'rightHip', 'leftKnee', 'rightKnee', 'leftAnkle', 'rightAnkle'];
export const NUM_KEYPOINTS = PART_NAMES.length;
export interface NumberDict {
  [jointName: string]: number;
}
export const PART_IDS = PART_NAMES.reduce(
  (result: NumberDict, jointName, i): NumberDict => {
    result[jointName] = i;
    return result;
  }, {});
const CONNECTED_PART_NAMES: StringTuple[] = [
  ['leftHip', 'leftShoulder'],
  ['leftElbow', 'leftShoulder'],
  ['leftElbow', 'leftWrist'],
  ['leftHip', 'leftKnee'],
  ['leftKnee', 'leftAnkle'],
  ['rightHip', 'rightShoulder'],
  ['rightElbow', 'rightShoulder'],
  ['rightElbow', 'rightWrist'],
  ['rightHip', 'rightKnee'],
  ['rightKnee', 'rightAnkle'],
  ['leftShoulder', 'rightShoulder'],
  ['leftHip', 'rightHip']];
// Define the skeleton. This defines the parent->child relationships of our tree. Arbitrarily
// this defines the nose as the root of the tree, however since we will infer the displacement for both
// parent->child and child->parent, we can define the tree root as any node.
export const POSE_CHAIN: StringTuple[] = [
  ['nose', 'leftEye'],
  ['leftEye', 'leftEar'],
  ['nose', 'rightEye'],
  ['rightEye', 'rightEar'],
  ['nose', 'leftShoulder'],
  ['leftShoulder', 'leftElbow'],
  ['leftElbow', 'leftWrist'],
  ['leftShoulder', 'leftHip'],
  ['leftHip', 'leftKnee'],
  ['leftKnee', 'leftAnkle'],
  ['nose', 'rightShoulder'],
  ['rightShoulder', 'rightElbow'],
  ['rightElbow', 'rightWrist'],
  ['rightShoulder', 'rightHip'],
  ['rightHip', 'rightKnee'],
  ['rightKnee', 'rightAnkle']];
export const CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(
  ([jointNameA, jointNameB]) => ([PART_IDS[jointNameA], PART_IDS[jointNameB]]);
)";
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 */
=====
*/
import {NUM_KEYPOINTS} from '../keypoints';
import {Padding, Part, TensorBuffer3D, Vector2D} from '../types';
export function getScale(
  height: number, width: number,
  inputResolutionY: number, inputResolutionX: number,
  padding: Padding): [number, number] {
  const {top: padT, bottom: padB, left: padL, right: padR} = padding;
  const scaleY = inputResolutionY / (padT + padB + height);
  const scaleX = inputResolutionX / (padL + padR + width);
  return [scaleX, scaleY];
}
export function getOffsetPoint(
  y: number, x: number, keypoint: number, offsets: TensorBuffer3D): Vector2D {
  return {
    y: offsets.get(y, x, keypoint),
    x: offsets.get(y, x, keypoint + NUM_KEYPOINTS)
  };
}
export function getImageCoords(
  part: Part, outputStride: number, offsets: TensorBuffer3D): Vector2D {
  const {heatmapY, heatmapX, id: keypoint} = part;
  const {y, x} = getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);
  return {
    x: part.heatmapX * outputStride + x,
    y: part.heatmapY * outputStride + y
  };
}
export function fillArray<T>(element: T, size: number): T[] {
  const result: T[] = new Array(size);
  for (let i = 0; i < size; i++) {
    result[i] = element;
  }
  return result;
}
export function clamp(a: number, min: number, max: number): number {
  if (a < min) return min;
  if (a > max) return max;
  return a;
}
export function squaredDistance(y1: number, x1: number, y2: number, x2: number): number {
  const dy = y2 - y1;
  const dx = x2 - x1;
  return dy * dy + dx * dx;
}
export function addVectors(a: Vector2D, b: Vector2D): Vector2D {
  return {x: a.x + b.x, y: a.y + b.y};
}
export function clampVector(a: Vector2D, min: number, max: number): Vector2D {
  return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};
}
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 */

```


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```
=====\n*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose} from './types';\nimport {getScale} from './util';\n\ninterface Pair {\n  x: number;\n  y: number;\n}\n\nfunction computeDistance(embedding: Pair[], pose: Pose, minPartScore = 0.3) {\n  let distance = 0.0;\n  let numKpt = 0;\n  for (let p = 0; p < embedding.length; p++) {\n    if (pose.keypoints[p].score > minPartScore) {\n      numKpt += 1;\n      distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n        (embedding[p].y - pose.keypoints[p].position.y) ** 2;\n    }\n  }\n  if (numKpt === 0) {\n    distance = Infinity;\n  } else {\n    distance = distance / numKpt;\n  }\n  return distance;\n}\n\nfunction convertToPositionInOutput(\n  position: Pair, [padT, padL]: [number, number],\n  [scaleX, scaleY]: [number, number], stride: number): Pair {\n  const y = Math.round(((padT + position.y + 1.0) * scaleY - 1.0) / stride);\n  const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n  return {x, y};\n}\n\nfunction getEmbedding(\n  location: Pair, keypointIndex: number, convertToPosition: (pair: Pair) => Pair,\n  outputResolutionX: number, longOffsets: Float32Array, refineSteps: number,\n  [height, width]: [number, number]): Pair {\n  const newLocation = convertToPosition(location);\n  const nn = newLocation.y * outputResolutionX + newLocation.x;\n  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n  let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n  let y = location.y + dy;\n  let x = location.x + dx;\n  for (let t = 0; t < refineSteps; t++) {\n    y = Math.min(y, height - 1);\n    x = Math.min(x, width - 1);\n    const newPos = convertToPosition({x, y});\n    const nn = newPos.y * outputResolutionX + newPos.x;\n    dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n    dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n    y = y + dy;\n    x = x + dx;\n  }\n  return {x, y};\n}\n\nfunction matchEmbeddingToInstance(\n  location: Pair, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number,\n  [padT, padL]: [number, number], [scaleX, scaleY]: [number, number], outputResolutionX: number,\n  [height, width]: [number, number], stride: number, refineSteps: number): number {\n  const embed: Pair[] = [];\n  const convertToPosition = (pair: Pair) => convertToPositionInOutput(pair, [padT, padL], [scaleX, scaleY], stride);\n  for (let keypointsIndex = 0; keypointsIndex < numKptForMatching; keypointsIndex++) {\n    const embedding = getEmbedding(\n      location, keypointsIndex, convertToPosition, outputResolutionX,\n      longOffsets, refineSteps, [height, width]);\n    embed.push(embedding);\n  }\n  let kMin = -1;\n  let kMinDist = Infinity;\n  for (let k = 0; k < poses.length; k++) {\n    const dist = computeDistance(embed, poses[k]);\n    if (dist < kMinDist) {\n      kMin = k;\n      kMinDist = dist;\n    }\n  }\n  return kMin;\n}\n\nfunction getOutputResolution(\n  [inputResolutionY, inputResolutionX]: [number, number], stride: number): [number, number] {\n  const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);\n  const outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);\n  return [outputResolutionX, outputResolutionY];\n}\n\nexport function decodeMultipleMasksCPU(\n  segmentation: Uint8Array, longOffsets: Float32Array, posesAboveScore: Pose[],\n  height: number, width: number, stride: number, [inHeight, inWidth]: [number, number],\n  padding: Padding, refineSteps: number, numKptForMatching = 5): Uint8Array[] {\n  const dataArray = posesAboveScore.map(x => new Uint8Array(height * width).fill(0));\n  const {top: padT, left: padL} = padding;\n  const [scaleX, scaleY] = getScale([height, width], [inHeight, inWidth], padding);\n  const [outputResolutionX, ] = getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1) {\n    for (let j = 0; j < width; j += 1) {\n      const n = i * width + j;\n      const prob = segmentation[n];\n      if (prob === 1) {\n        const kMin = matchEmbeddingToInstance(\n          {x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching,\n          [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],\n          stride, refineSteps);\n        if (kMin >= 0) {\n          dataArray[kMin][n] = 1;\n        }\n      }\n    }\n  }\n  return dataArray;\n}
```

```

dataArrays;\n}\n\nexport function decodeMultiplePartMasksCPU(\n
  segmentation: Uint8Array, longOffsets: Float32Array,\n  partSegmentaion: Uint8Array, posesAboveScore:
  Pose[], height: number,\n  width: number, stride: number, [inHeight, inWidth]: [number, number],\n  padding:
  Padding, refineSteps: number,\n  numKptForMatching = 5): Int32Array[] {\n  const dataArrays =\n  posesAboveScore.map(x => new Int32Array(height * width).fill(-1));\n  const {top: padT, left: padL} =
  padding;\n  const [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const
  [outputResolutionX, ] =\n  getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1)
  {\n  for (let j = 0; j < width; j += 1) {\n  const n = i * width + j;\n  const prob = segmentation[n];\n  if (prob
  === 1) {\n  const kMin = matchEmbeddingToInstance(\n  {x: j, y: i}, longOffsets, posesAboveScore,
  numKptForMatching,\n  [padT, padL], [scaleX, scaleY], outputResolutionX, [height,
  width],\n  stride, refineSteps);\n  if (kMin >= 0) {\n  dataArrays[kMin][n] = partSegmentaion[n];\n
  }\n  }\n  }\n  }\n  return dataArrays;\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights
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  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from '@tensorflow/tfjs-backend-
  webgl';\n\nimport
  {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Pose} from '../types';\nimport {getScale} from
  './util';\n\nexport function decodeMultipleMasksWebGl(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n
  posesAboveScore: Pose[], height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number,
  number], padding: Padding,\n  refineSteps: number, minKptScore: number,\n  maxNumPeople: number):
  tf.TensorInfo {\n  // The height/width of the image/canvas itself.\n  const [origHeight, origWidth] =
  segmentation.shape;\n  // The height/width of the output of the model.\n  const [outHeight, outWidth] =
  longOffsets.shape.slice(0, 2);\n  const shapedLongOffsets: tf.Tensor4D =\n  tf.reshape(longOffsets, [outHeight,
  outWidth, 2, NUM_KEYPOINTS]);\n  // Make pose tensor of shape [MAX_NUM_PEOPLE,
  NUM_KEYPOINTS, 3] where\n  // the last 3 coordinates correspond to the score, h and w coordinate of that\n  //
  keypoint.\n  const poseVals
  = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n  for (let i = 0; i <
  posesAboveScore.length; i++) {\n  const poseOffset = i * NUM_KEYPOINTS * 3;\n  const pose =
  posesAboveScore[i];\n  for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n  const keypoint =
  pose.keypoints[kp];\n  const offset = poseOffset + kp * 3;\n  poseVals[offset] = keypoint.score;\n
  poseVals[offset + 1] = keypoint.position.y;\n  poseVals[offset + 2] = keypoint.position.x;\n  }\n  }\n  const
  [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n  const posesTensor =
  tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n  const {top: padT, left: padL} = padding;\n
  const program: tf_webgl.GPGPUProgram = {\n  variableNames: ['segmentation', 'longOffsets', 'poses'],\n
  outputShape: [origHeight, origWidth],\n  userCode: `\n  int convertToPositionInOut(int pos, int pad, float
  scale, int stride) {\n  return round(((float(pos +
  pad) + 1.0) * scale - 1.0) / float(stride));\n  }\n\n  float convertToPositionInOutFloat(\n  int pos, int pad,
  float scale, int stride) {\n  return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);\n  }\n\n  float
  dist(float x1, float y1, float x2, float y2) {\n  return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);\n  }\n\n  float
  sampleLongOffsets(float h, float w, int d, int k) {\n  float fh = fract(h);\n  float fw = fract(w);\n  int
  clH = int(ceil(h));\n  int clW = int(ceil(w));\n  int flH = int(floor(h));\n  int flW = int(floor(w));\n  float
  o11 = getLongOffsets(flH, flW, d, k);\n  float o12 = getLongOffsets(flH, clW, d, k);\n  float o21 =
  getLongOffsets(clH, flW, d, k);\n  float o22 = getLongOffsets(clH, clW, d, k);\n  float o1 = mix(o11, o12,

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fw);\n    float o2 = mix(o21, o22, fw);\n    return mix(o1, o2, fh);\n    }\n\n    int findNearestPose(int h, int w) {\n        float prob = getSegmentation(h, w);\n        if (prob < 1.0) {\n            return -1;\n        }\n        // Done(Tyler): convert from output space h/w to strided space.\n        float stridedH = convertToPositionInOutFloat(\n            h, ${padT}, ${scaleY}, ${stride});\n        float stridedW =\n        convertToPositionInOutFloat(\n            w, ${padL}, ${scaleX}, ${stride});\n        float minDist = 1000000.0;\n        int iMin = -1;\n        for (int i = 0; i < ${maxNumPeople}; i++) {\n            float curDistSum = 0.0;\n            int numKpt =\n            0;\n            for (int k = 0; k < ${NUM_KEYPOINTS}; k++) {\n                float dy = sampleLongOffsets(stridedH,\n                stridedW, 0, k);\n                float dx = sampleLongOffsets(stridedH, stridedW, 1, k);\n                float y = float(h) + dy;\n                float x = float(w) + dx;\n                for (int s = 0; s < ${refineSteps}; s++) {\n                    int yRounded = round(min(y,\n                    float(${height} - 1.0)));\n                    int xRounded = round(min(x, float(${width} - 1.0)));\n                    float yStrided =\n                    convertToPositionInOutFloat(\n                        yRounded, ${padT}, ${scaleY}, ${stride});\n                    float xStrided = convertToPositionInOutFloat(\n                        xRounded, ${padL}, ${scaleX}, ${stride});\n                    float dy = sampleLongOffsets(yStrided, xStrided, 0,\n                    k);\n                    float dx = sampleLongOffsets(yStrided, xStrided, 1, k);\n                    y = y + dy;\n                    x = x + dx;\n                }\n                float poseScore = getPoses(i, k, 0);\n                float poseY = getPoses(i, k, 1);\n                float poseX =\n                getPoses(i, k, 2);\n                if (poseScore > ${minKptScore}) {\n                    numKpt = numKpt + 1;\n                    curDistSum\n                    = curDistSum + dist(x, y, poseX, poseY);\n                }\n                if (numKpt > 0 && curDistSum / float(numKpt) <\n                minDist) {\n                    minDist = curDistSum / float(numKpt);\n                    iMin = i;\n                }\n            }\n        }\n        return iMin;\n    }\n\n    void main() {\n        ivec2 coords = getOutputCoords();\n        int nearestPose = findNearestPose(coords[0],\n        coords[1]);\n\n        setOutput(float(nearestPose));\n    }\n\n    const webglBackend = tf.backend() as\n    tf_webgl.MathBackendWebGL;\n    return webglBackend.compileAndRun(\n        program, [segmentation,\n        shapedLongOffsets, posesTensor]);\n\n    /**\n     * @license\n     * Copyright 2019 Google Inc. All Rights Reserved.\n     * Licensed under the Apache License, Version 2.0 (the "License");\n     * you may not use this file except in\n     * compliance with the License.\n     * You may obtain a copy of the License at\n     * http://www.apache.org/licenses/LICENSE-2.0\n     * Unless required by applicable law or agreed to in writing,\n     * software\n     * distributed under the License is distributed on an "AS IS" BASIS,\n     * WITHOUT WARRANTIES\n     * OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the License for the specific language\n     * governing permissions and\n     * limitations under the License.\n     *\n     *=====\n     *\n     *\n     * as tf from '@tensorflow/tfjs-core';\n     * import\n     * {getBackend} from '@tensorflow/tfjs-core';\n     * import {Padding, PartSegmentation, PersonSegmentation, Pose}\n     * from '../types';\n     * import {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from\n     * './decode_multiple_masks_cpu';\n     * import {decodeMultipleMasksWebGL} from\n     * './decode_multiple_masks_webgl';\n     * export function toPersonKSegmentation(\n     * segmentation: tf.Tensor2D, k:\n     * number): tf.Tensor2D {\n     * return tf.tidy(() => (tf.cast(tf.equal(\n     * segmentation, tf.scalar(k)), 'int32') as\n     * tf.Tensor2D));\n     * }\n     * export function toPersonKPartSegmentation(\n     * segmentation: tf.Tensor2D, bodyParts:\n     * tf.Tensor2D, k: number): tf.Tensor2D {\n     * return tf.tidy(() => tf.sub(tf.mul(tf.cast(tf.equal(\n     * segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));\n     * }\n     * function isWebGLBackend() {\n     * return\n     * getBackend() === 'webgl';\n     * }\n     * export async function decodePersonInstanceMasks(\n     * segmentation:\n     * tf.Tensor2D, longOffsets: tf.Tensor3D, poses:\n     * Pose[],\n     * height: number, width: number, stride: number,\n     * [inHeight, inWidth]: [number, number], padding:\n     * Padding, minPoseScore = 0.2,\n     * refineSteps = 8, minKeypointScore = 0.3,\n     * maxNumPeople = 10):\n     * Promise<PersonSegmentation[]> {\n     * // Filter out poses with smaller score.\n     * const posesAboveScore =\n     * poses.filter(pose => pose.score >= minPoseScore);\n     * let personSegmentationsData: Uint8Array[];\n     * if\n     * (isWebGLBackend()) {\n     * const personSegmentations = tf.tidy(() => {\n     * const masksTensorInfo =\n     * decodeMultipleMasksWebGL(\n     * segmentation, longOffsets, posesAboveScore, height, width, stride,\n     * [inHeight, inWidth], padding, refineSteps, minKeypointScore,\n     * maxNumPeople);\n     * const masksTensor =

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tf.engine().makeTensorFromDataId(\n      masksTensorInfo.dataId, masksTensorInfo.shape,\n      masksTensorInfo.dtype) as tf.Tensor2D;\n\n      return posesAboveScore.map(\n          (_, k) =>\n          toPersonKSegmentation(masksTensor, k));\n      });\n\n      personSegmentationsData =\n          (await Promise.all(personSegmentations.map(mask => mask.data())) as\n          Uint8Array[]);\n\n      personSegmentations.forEach(x => x.dispose());\n      } else {\n          const segmentationsData =\n          await segmentation.data() as Uint8Array;\n          const longOffsetsData = await longOffsets.data() as Float32Array;\n          personSegmentationsData = decodeMultipleMasksCPU(\n              segmentationsData, longOffsetsData,\n              posesAboveScore, height, width,\n              stride, [inHeight, inWidth], padding, refineSteps);\n      }\n\n      return\n      personSegmentationsData.map(\n          (data, i) => ({data, pose: posesAboveScore[i], width, height}));\n      }\n\n      export\n      async function decodePersonInstancePartMasks(\n          segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n          partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n          stride: number, [inHeight,\n          inWidth]: [number, number], padding: Padding,\n          minPoseScore = 0.2, refineSteps = 8, minKeypointScore =\n          0.3,\n          maxNumPeople = 10): Promise<PartSegmentation[]> {\n          const posesAboveScore = poses.filter(pose =>\n          pose.score >= minPoseScore);\n          let partSegmentationsByPersonData: Int32Array[];\n          if (isWebGLBackend())\n          {\n              const partSegmentations = tf.tidy(() => {\n                  const masksTensorInfo = decodeMultipleMasksWebGL(\n                  segmentation, longOffsets, posesAboveScore, height, width, stride,\n                  [inHeight, inWidth], padding,\n                  refineSteps, minKeypointScore,\n                  maxNumPeople);\n                  const masksTensor =\n                  tf.engine().makeTensorFromDataId(\n                  masksTensorInfo.dataId, masksTensorInfo.shape,\n                  masksTensorInfo.dtype) as tf.Tensor2D;\n                  return posesAboveScore.map(\n                      (_, k) =>\n                      toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n                  });\n                  partSegmentationsByPersonData =\n                  (await Promise.all(partSegmentations.map(x => x.data()))) as\n                  Int32Array[];\n                  partSegmentations.forEach(x => x.dispose());\n              } else\n              {\n                  const segmentationsData = await segmentation.data() as Uint8Array;\n                  const longOffsetsData = await\n                  longOffsets.data() as Float32Array;\n                  const partSegmentaionData = await partSegmentation.data() as\n                  Uint8Array;\n                  partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n                  segmentationsData,\n                  longOffsetsData, partSegmentaionData,\n                  posesAboveScore, height, width, stride, [inHeight, inWidth],\n                  padding,\n                  refineSteps);\n              }\n              return partSegmentationsByPersonData.map(\n                  (data, k) => ({pose:\n                  posesAboveScore[k], data, height, width}));\n          }\n      }\n\n      /**\n      * @license\n      * Copyright 2019 Google Inc. All Rights\n      Reserved.\n      * Licensed under the Apache License, Version 2.0 (the \"License\");\n      * you may not use this file\n      except in compliance with the License.\n      * You may obtain a copy of the License at\n      *  

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      =====\n      *\n      *\n      // algorithm based on Coursera Lecture from Algorithms, Part 1:\n      //  

      https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n      \n      function half(k: number) {\n          return\n          Math.floor(k / 2);\n      }\n      \n      export class MaxHeap<T> {\n          private priorityQueue: T[];\n          private numberOfElements:\n          number;\n          private getElementValue: (element: T) => number;\n          constructor(maxSize: number, getElementValue:\n          (element: T) => number) {\n              this.priorityQueue = new Array(maxSize);\n              this.numberOfElements = -1;\n              this.getElementValue = getElementValue;\n          }\n          public enqueue(x: T): void {\n              this.priorityQueue[++this.numberOfElements] = x;\n              this.swim(this.numberOfElements);\n          }\n          public dequeue(): T {\n              const max = this.priorityQueue[0];\n              this.exchange(0, this.numberOfElements--\n          );\n              this.sink(0);\n              this.priorityQueue[this.numberOfElements + 1] = null;\n              return max;\n          }\n          public empty(): boolean {\n              return this.numberOfElements === -1;\n          }\n          public size(): number {\n              return\n              this.numberOfElements + 1;\n          }\n          public all(): T[] {\n              return this.priorityQueue.slice(0, this.numberOfElements

```

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+ 1);
}

public max(): T {
    return this.priorityQueue[0];
}

private swim(k: number): void {
    while (k > 0 && this.less(half(k), k)) {
        this.exchange(k, half(k));
        k = half(k);
    }
}

private sink(k: number): void {
    while (2 * k <= this.numberOfElements) {
        let j = 2 * k;
        if (j < this.numberOfElements && this.less(j, j + 1)) {
            j++;
        }
        if (!this.less(k, j)) {
            break;
        }
        this.exchange(k, j);
        k = j;
    }
}

private getValueAt(i: number): number {
    return this.getElementValue(this.priorityQueue[i]);
}

private less(i: number, j: number): boolean {
    return this.getValueAt(i) < this.getValueAt(j);
}

private exchange(i: number, j: number): void {
    const t = this.priorityQueue[i];
    this.priorityQueue[i] = this.priorityQueue[j];
    this.priorityQueue[j] = t;
}
}

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 * limitations under the License.
 */

=====
import {PartWithScore, TensorBuffer3D} from '../types';
import {MaxHeap} from './max_heap';

function scoreIsMaximumInLocalWindow(
    keypointId: number, score: number, heatmapY: number, heatmapX: number,
    localMaximumRadius: number, scores: TensorBuffer3D): boolean {
    const [height, width] = scores.shape;
    let localMaximum = true;
    const yStart = Math.max(heatmapY - localMaximumRadius, 0);
    const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);
    for (let yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {
        const xStart = Math.max(heatmapX - localMaximumRadius, 0);
        const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);
        for (let xCurrent = xStart; xCurrent < xEnd; ++xCurrent) {
            if (scores.get(yCurrent, xCurrent, keypointId) > score) {
                localMaximum = false;
                break;
            }
        }
        if (!localMaximum) {
            break;
        }
    }
    return localMaximum;
}

/**
 * Builds a priority queue with part candidate positions for a specific image in
 * the batch. For this we find all local maxima in the score maps with score
 * values above a threshold. We create a single priority queue across all parts.
 */
export function buildPartWithScoreQueue(
    scoreThreshold: number, localMaximumRadius: number,
    scores: TensorBuffer3D): MaxHeap<PartWithScore> {
    const [height, width, numKeypoints] = scores.shape;
    const queue = new MaxHeap<PartWithScore>(
        height * width * numKeypoints, ({score}) => score);
    for (let heatmapY = 0; heatmapY < height; ++heatmapY) {
        for (let heatmapX = 0; heatmapX < width; ++heatmapX) {
            for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {
                const score = scores.get(heatmapY, heatmapX, keypointId);
                // Only consider parts with score greater or equal to threshold as
                // root candidates.
                if (score < scoreThreshold) {
                    continue;
                }
                // Only consider keypoints whose score is maximum in a local window.
                if (scoreIsMaximumInLocalWindow(
                    keypointId, score, heatmapY, heatmapX, localMaximumRadius,
                    scores)) {
                    queue.enqueue({score, part: {heatmapY, heatmapX, id: keypointId}});
                }
            }
        }
    }
    return queue;
}

"/**
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 */

=====
import {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';
import {Keypoint,

```

```

PartWithScore, TensorBuffer3D, Vector2D} from './types';\n\nimport {clamp, getOffsetPoint} from './util';\nimport
{addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n ([parentJoinName, childJoinName]): NumberTuple =>\n
([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\n
parentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\n
parentChildrenTuples.map(([\n      parentJointId,\n      ])=>
parentJointId);\n\nfunction getDisplacement(\n edgeId: number, point: Vector2D, displacements:
TensorBuffer3D): Vector2D {\n const numEdges =
displacements.shape[2] / 2;\n return {\n y: displacements.get(point.y, point.x, edgeId),\n x:
displacements.get(point.y, point.x, numEdges + edgeId)\n };}\n\nfunction getStridedIndexNearPoint(\n point:
Vector2D, outputStride: number, height: number,\n width: number): Vector2D {\n return {\n y:
clamp(Math.round(point.y / outputStride), 0, height - 1),\n x: clamp(Math.round(point.x / outputStride), 0, width -
1)\n };}\n\n/**\n * We get a new keypoint along the `edgeId` for the pose instance, assuming\n * that the position
of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target
part (stored in\n * the `i`-th channel of the displacement tensor). The displaced keypoint\n * vector is refined using
the offset vector by `offsetRefineStep` times.\n */\nfunction traverseToTargetKeypoint(\n edgeId: number,
sourceKeypoint: Keypoint, targetKeypointId: number,\n scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D,
outputStride: number,\n displacements: TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n const [height,
width] = scoresBuffer.shape;\n\n // Nearest neighbor interpolation for the source->target displacements.\n const
sourceKeypointIndices = getStridedIndexNearPoint(\n sourceKeypoint.position, outputStride, height, width);\n\n const
displacement =\n getDisplacement(edgeId, sourceKeypointIndices, displacements);\n\n const
displacedPoint = addVectors(sourceKeypoint.position, displacement);\n\n let targetKeypoint = displacedPoint;\n\n for
(let i = 0; i < offsetRefineStep; i++) {\n const targetKeypointIndices =\n
getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n\n const offsetPoint = getOffsetPoint(\n
targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId,\n offsets);\n\n targetKeypoint =
addVectors(\n {\n x: targetKeypointIndices.x * outputStride,\n y: targetKeypointIndices.y
* outputStride\n },\n {x: offsetPoint.x, y: offsetPoint.y});\n }\n\n const targetKeypointIndices =\n
getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n\n const score = scoresBuffer.get(\n
targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId);\n\n return {position: targetKeypoint, part:
PART_NAMES[targetKeypointId], score};}\n\n/**\n * Follows the displacement fields to decode the full pose of
the object\n * instance given the position of a part that acts as root.\n */\n * @return An array of decoded keypoints
and their scores for a single pose\n */\nexport function decodePose(\n root: PartWithScore, scores:
TensorBuffer3D, offsets: TensorBuffer3D,\n outputStride: number, displacementsFwd: TensorBuffer3D,\n
displacementsBwd: TensorBuffer3D): Keypoint[] {\n const numParts = scores.shape[2];\n const numEdges =
parentToChildEdges.length;\n\n const instanceKeypoints: Keypoint[] = new Array(numParts);\n\n // Start a new
detection instance at the position of the root.\n const {part: rootPart, score: rootScore} = root;\n const rootPoint =
getImageCoords(rootPart, outputStride, offsets);\n\n instanceKeypoints[rootPart.id] = {\n score: rootScore,\n
part: PART_NAMES[rootPart.id],\n position: rootPoint\n };}\n\n // Decode the part positions upwards in the tree,
following the backward\n // displacements.\n for (let edge = numEdges - 1; edge >= 0; --edge) {\n const
sourceKeypointId = parentToChildEdges[edge];\n const targetKeypointId = childToParentEdges[edge];\n\n if
(instanceKeypoints[sourceKeypointId] &&\n !instanceKeypoints[targetKeypointId]) {\n
instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n edge,\n
instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n offsets, outputStride, displacementsBwd);\n
}\n }\n\n // Decode the part positions downwards in the tree, following the forward\n // displacements.\n for (let
edge = 0;\n edge < numEdges; ++edge) {\n const sourceKeypointId = childToParentEdges[edge];\n const targetKeypointId
= parentToChildEdges[edge];\n\n if (instanceKeypoints[sourceKeypointId] &&\n
!instanceKeypoints[targetKeypointId]) {\n instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n

```

edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n offsets, outputStride,
displacementsFwd);\n };\n }\n\n return instanceKeypoints;\n}\n","/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

=====
*\n\nimport { Keypoint, Pose, TensorBuffer3D } from './types';\n\nimport { buildPartWithScoreQueue } from  

'./build_part_with_score_queue';\nimport { decodePose } from './decode_pose';\nimport { getImageCoords,  

squaredDistance } from './util';\n\nfunction withinNmsRadiusOfCorrespondingPoint(\n poses: Pose[],  

squaredNmsRadius: number, {x, y}: {x: number, y: number},\n keypointId: number): boolean {\n return  

poses.some(({ keypoints }) => {\n const correspondingKeypoint = keypoints[keypointId].position;\n return  

squaredDistance(\n y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n  

squaredNmsRadius;\n });\n}\n\n* Score the newly proposed object instance without taking into account\n * the  

scores of the parts that overlap with any previously detected\n  

* instance.\n */\nfunction getInstanceScore(\n existingPoses: Pose[], squaredNmsRadius: number,\n instanceKeypoints: Keypoint[]): number {\n let notOverlappedKeypointScores = instanceKeypoints.reduce(\n  

(result, {position, score}, keypointId): number => {\n if (!withinNmsRadiusOfCorrespondingPoint(\n  

existingPoses, squaredNmsRadius, position, keypointId)) {\n result += score;\n }\n return result;\n  

}, 0.0);\n return notOverlappedKeypointScores /= instanceKeypoints.length;\n}\n\n// A point (y, x) is considered  

as root part candidate if its score is a\n// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n//  

kLocalMaximumRadius.\nconst kLocalMaximumRadius = 1;\n\n/**\n * Detects multiple poses and finds their parts  

from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in  

decreasing root score order. It works as follows: We first\n * create a priority  

queue with local part score maxima above\n * `scoreThreshold`, considering all parts at the same time. Then we\n *  

iteratively pull the top element of the queue (in decreasing score order)\n * and treat it as a root candidate for a new  

object instance. To avoid\n * duplicate detections, we reject the root candidate if it is within a disk\n * of  

`nmsRadius` pixels from the corresponding part of a previously detected\n * instance, which is a form of part-based  

non-maximum suppression (NMS). If\n * the root candidate passes the NMS check, we start a new object instance\n *  

detection, treating the corresponding part as root and finding the\n * positions of the remaining parts by following  

the displacement vectors\n * along the tree-structured part graph. We assign to the newly detected\n * instance a  

score equal to the sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at  

least `nmsRadius`\n * pixels away from the corresponding part of all previously  

detected\n * instances), divided by the total number of parts `numParts`.\n *\n * @param heatmapScores 3-D tensor  

with shape `[height, width, numParts]`. \n * The value of heatmapScores[y, x, k]` is the score of placing the `k`-th\n  

* object part at position `(y, x)`. \n *\n * @param offsets 3-D tensor with shape `[height, width, numParts * 2]`. \n *\n * The value of [offsets[y, x, k], offsets[y, x, k + numParts]]` is the\n * short range offset vector of the `k`-th object  

part at heatmap\n * position `(y, x)`. \n *\n * @param displacementsFwd 3-D tensor of shape\n * `[height, width, 2 *  

num_edges]`, where `num_edges = num_parts - 1` is the\n * number of edges (parent-child pairs) in the tree. It  

contains the forward\n * displacements between consecutive part from the root towards the leaves.\n *\n * @param  

displacementsBwd 3-D tensor of shape\n * `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is  

the\n * number of edges (parent-child pairs) in the tree. It contains  

the backward\n * displacements between consecutive part from the root towards the leaves.\n *\n * @param  

outputStride The output stride that was used when feed-forwarding\n * through the PoseNet model. Must be 32, 16,  

or 8.\n *\n * @param maxPoseDetections Maximum number of returned instance detections per\n * image.\n *\n *

```

```

@param scoreThreshold Only return instance detections that have root part\n * score greater or equal to this value.
Defaults to 0.5.\n * \n * @param nmsRadius Non-maximum suppression part distance. It needs to be\n * strictly
positive. Two parts suppress each other if they are less than\n * `nmsRadius` pixels away. Defaults to 20.\n * \n *
@return An array of poses and their scores, each containing keypoints and\n * the corresponding keypoint scores.\n
*/\nexport function decodeMultiplePoses(\n  scoresBuffer: TensorBuffer3D, offsetsBuffer: TensorBuffer3D,\n  displacementsFwdBuffer: TensorBuffer3D,\n  displacementsBwdBuffer: TensorBuffer3D, outputStride: number,\n  maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {\n  const poses: Pose[] = [];\n  const queue = buildPartWithScoreQueue(\n    scoreThreshold, kLocalMaximumRadius, scoresBuffer);\n  const squaredNmsRadius = nmsRadius * nmsRadius;\n  // Generate at most maxDetections object instances per image
in\n  // decreasing root part score order.\n  while (poses.length < maxPoseDetections && !queue.empty()) {\n  //
The top element in the queue is the next root candidate.\n  const root = queue.dequeue();\n  // Part-based non-
maximum suppression: We reject a root candidate if it\n  // is within a disk of `nmsRadius` pixels from the
corresponding part of\n  // a previously detected instance.\n  const rootImageCoords =\n  getImageCoords(root.part, outputStride, offsetsBuffer);\n  if (withinNmsRadiusOfCorrespondingPoint(\n
poses, squaredNmsRadius, rootImageCoords, root.part.id)) {\n  continue;\n  }\n  // Start a new detection
instance at the position of the root.\n  const keypoints = decodePose(\n    root, scoresBuffer, offsetsBuffer,\n
outputStride, displacementsFwdBuffer,\n    displacementsBwdBuffer);\n  const score =
getInstanceScore(poses, squaredNmsRadius, keypoints);\n  poses.push({keypoints, score});\n  }\n  return
poses;\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache
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License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport { BaseModel } from './base_model';\n\nconst
imageNetMean = [-123.15, -115.90, -103.06];\n\nexport class ResNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n  return tf.add(input, imageNetMean);\n  }\n  nameOutputResults(results: tf.Tensor3D[]) {\n  const [\n    displacementBwd,\n    displacementFwd,\n    heatmap,\n    longOffsets,\n    offsets,\n    partHeatmaps,\n    segmentation,\n    partOffsets,\n  ] = results;\n  return {\n    offsets,\n    segmentation,\n    partHeatmaps,\n    longOffsets,\n    heatmap,\n    displacementFwd,\n    displacementBwd,\n    partOffsets\n  };}\n}\n", "/*\n * @license\n * Copyright 2019
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=====\n
*/\n\nconst RESNET50_BASE_URL =\n  'https://storage.googleapis.com/tfjs-
models/savedmodel/bodypix/resnet50/';\nconst MOBILENET_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet';\n\n// The BodyPix 2.0 ResNet50
models use the latest TensorFlow.js 1.0 model\n// format.\nexport function resNet50SavedModel(stride: number,\n  quantBytes: number): string {\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding
to the non-quantized
full-precision SavedModel.\n  if (quantBytes === 4) {\n  return RESNET50_BASE_URL + `float^` + graphJson;\n  } else {\n  return RESNET50_BASE_URL + `quant${quantBytes}^` + graphJson;\n  }\n}\n\n// The BodyPix 2.0
MobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function mobileNetSavedModel(\n

```



```

stride: number, multiplier: number, quantBytes: number): string {\n  const toStr: {[key: number]: string} = {1.0:
'100', 0.75: '075', 0.50: '050'};\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding
to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return MOBILENET_BASE_URL +
`float/${toStr[multiplier]}^` + graphJson;\n  } else {\n    return MOBILENET_BASE_URL +
`quant${quantBytes}/${toStr[multiplier]}^` +\n    graphJson;\n  }\n}\n", "/*\n * @license\n * Copyright 2020
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n *
=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport {BodyPixInput, BodyPixOutputStride, Padding} from
'./types';\nimport {Pose, TensorBuffer3D} from './types';\nimport {BodyPixInternalResolution} from
'./types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\nHTMLCanvasElement|\n      OffscreenCanvas): [number, number] {\n  if ('offsetHeight'
in input && input.offsetHeight !== 0\n    && 'offsetWidth' in input && input.offsetWidth !== 0) {\n    return
[input.offsetHeight, input.offsetWidth];\n  } else if (input.height !== null && input.width !== null) {\n    return
[input.height, input.width];\n  } else {\n    throw new Error(\n      `HTMLImageElement must have height and
width attributes set.`);\n  }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,
number] {\n  if (input.hasAttribute('height') && input.hasAttribute('width')) {\n    // Prioritizes user specified height
and width.\n    // We can't test the .height and .width properties directly,\n    // because they evaluate to 0 if unset.\n    return [input.height, input.width];\n  } else {\n    return [input.videoHeight, input.videoWidth];\n  }\n}\n\nexport
function getInputSize(input: BodyPixInput): [number, number] {\n  if ((typeof (HTMLCanvasElement) !==
'undefined' &&\n    input instanceof HTMLCanvasElement) ||\n    (typeof (OffscreenCanvas)
!== 'undefined' &&\n    input instanceof OffscreenCanvas) ||\n    (typeof (HTMLImageElement) !==
'undefined' &&\n    input instanceof HTMLImageElement)) {\n    return getSizeFromImageLikeElement(input);\n  }
else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {\n    return [input.height,
input.width];\n  } else if (\n    typeof (HTMLVideoElement) !== 'undefined' &&\n    input instanceof
HTMLVideoElement) {\n    return getSizeFromVideoElement(input);\n  } else if (input instanceof tf.Tensor) {\n    return
[input.shape[0], input.shape[1]];\n  } else {\n    throw new Error(`error: Unknown input type: ${input}`);\n  }\n}\n\nfunction isValidInputResolution(\n  resolution: number, outputStride: number): boolean {\n  return
(resolution - 1) % outputStride === 0;\n}\n\nexport function toValidInputResolution(\n  inputResolution: number,
outputStride: BodyPixOutputStride): number {\n  if (isValidInputResolution(inputResolution, outputStride)) {\n    return
inputResolution;\n  }\n  return Math.floor(inputResolution / outputStride) * outputStride + 1;\n}\n\nconst
INTERNAL_RESOLUTION_STRING_OPTIONS = {\n  low: 'low',\n  medium: 'medium',\n  high: 'high',\n  full:
'full'\n};\n\nconst INTERNAL_RESOLUTION_PERCENTAGES = {\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst MIN_INTERNAL_RESOLUTION =
0.1;\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n  internalResolution:
BodyPixInternalResolution): number {\n  if (typeof internalResolution === 'string') {\n    const
result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n    tf.util.assert(\n      typeof result
=== 'number',\n      () => `string value of inputResolution must be one of $\n
Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n      .join(',')`

```

```

but was ${internalResolution}`);\n  return result;\n } else {\n  tf.util.assert(\n    typeof internalResolution ===
'number' &&\n    internalResolution <= MAX_INTERNAL_RESOLUTION &&\n    internalResolution
>= MIN_INTERNAL_RESOLUTION,\n    () =>\n      `inputResolution must be a string or number between
${\n        MIN_INTERNAL_RESOLUTION} and ${MAX_INTERNAL_RESOLUTION}, but ` +\n
`${internalResolution}`);\n  return internalResolution;\n }\n}\n\nexport function
toInputResolutionHeightAndWidth(\n  internalResolution: BodyPixInternalResolution,\n  outputStride:
BodyPixOutputStride,\n  [inputHeight, inputWidth]: [number, number]): [number, number] {\n  const
internalResolutionPercentage =\n    toInternalResolutionPercentage(internalResolution);\n  return [\n
toValidInputResolution(\n    inputHeight * internalResolutionPercentage, outputStride),\n
toValidInputResolution(\n    inputWidth * internalResolutionPercentage,\n
    outputStride)\n ];\n}\n\nexport function toInputTensor(input: BodyPixInput) {\n // TODO: tf.browser.fromPixels
types to support OffscreenCanvas\n // @ts-ignore\n return input instanceof tf.Tensor ? input :
tf.browser.fromPixels(input);\n}\n\nexport function resizeAndPadTo(\n  imageTensor: tf.Tensor3D, [targetH,
targetW]: [number, number],\n  flipHorizontal = false): {\n  resizedAndPadded: tf.Tensor3D,\n  paddedBy:
[[number, number], [number, number]]\n } {\n  const [height, width] = imageTensor.shape;\n  const targetAspect =
targetW / targetH;\n  const aspect = width / height;\n  let resizeW: number;\n  let resizeH: number;\n  let padL:
number;\n  let padR: number;\n  let padT: number;\n  let padB: number;\n  if (aspect > targetAspect) {\n // resize
to have the larger dimension match the shape.\n  resizeW = targetW;\n  resizeH = Math.ceil(resizeW / aspect);\n\n
const padHeight = targetH - resizeH;\n  padL = 0;\n  padR = 0;\n  padT = Math.floor(padHeight
/ 2);\n  padB = targetH - (resizeH + padT);\n } else {\n  resizeH = targetH;\n  resizeW = Math.ceil(targetH *
aspect);\n\n  const padWidth = targetW - resizeW;\n  padL = Math.floor(padWidth / 2);\n  padR = targetW -
(resizeW + padL);\n  padT = 0;\n  padB = 0;\n }\n\n  const resizedAndPadded = tf.tidy(() => {\n // resize to
have largest dimension match image\n  let resized: tf.Tensor3D;\n  if (flipHorizontal) {\n  resized =
tf.image.resizeBilinear(\n    tf.reverse(imageTensor, 1), [resizeH, resizeW]);\n } else {\n  resized =
tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n }\n\n  const padded = tf.pad3d(resized, [[padT,
padB], [padL, padR], [0, 0]]);\n  return padded;\n });\n  return {resizedAndPadded, paddedBy: [[padT, padB],
[padL, padR]]};\n}\n\nexport function scaleAndCropToInputTensorShape(\n  tensor: tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number, number],\n  [resizedAndPaddedHeight,
resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number, number], [number,
number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return tf.tidy(() => {\n  let inResizedAndPadded:
tf.Tensor3D = tf.image.resizeBilinear(tensor,\n    [resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n  if (applySigmoidActivation) {\n  inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n }\n\n  return
removePaddingAndResizeBack(\n    inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n    [[padT, padB], [padL, padR]]);\n });\n}\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded:
tf.Tensor3D,\n  [originalHeight, originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number,
number], [number, number]]):\n  tf.Tensor3D {\n  return tf.tidy(() => {\n  const batchedImage: tf.Tensor4D =
tf.expandDims(resizedAndPadded);\n  return tf.squeeze(tf.image\n    .cropAndResize(\n
batchedImage, [[\n      padT / (originalHeight + padT + padB - 1.0),\n      padL / (originalWidth +
padL + padR - 1.0),\n      (padT + originalHeight - 1.0) \/\n      (originalHeight + padT + padB - 1.0),\n
(padL + originalWidth - 1.0) / (originalWidth + padL + padR - 1.0)\n    ]),\n    [0], [originalHeight,
originalWidth]), [0]);\n });\n}\n\nexport function resize2d(\n  tensor: tf.Tensor2D, resolution: [number, number],\n  nearestNeighbor?: boolean): tf.Tensor2D {\n  return tf.tidy(() => {\n  const batchedImage: tf.Tensor4D =
tf.expandDims(tensor, 2);\n  return tf.squeeze(\n    tf.image.resizeBilinear(batchedImage, resolution,\n    nearestNeighbor));\n });\n}\n\nexport function padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]:
[number, number]):\n  {resized: tf.Tensor3D, padding: Padding} {\n  const [height, width] = getInputSize(input);\n  const targetAspect = targetW / targetH;\n  const aspect
= width / height;\n  let [padT, padB, padL, padR] = [0, 0, 0, 0];\n  if (aspect < targetAspect) {\n // pads the width\n
padT = 0;\n  padB = 0;\n  padL = Math.round(0.5 * (targetAspect * height - width));\n  padR = Math.round(0.5

```


more accurate
 * the model at the cost of speed. Set this to a larger value to increase speed
 * at the cost of accuracy. Stride 32 is supported for ResNet and
 * stride 8,16,32 are supported for various MobileNetV1 models.
 * multiplier: An optional number with values: 1.01, 1.0, 0.75, or
 * 0.50. The value is used only by MobileNet architecture. It is the float
 * multiplier for the depth (number of channels) for all convolution ops.
 * The larger the value, the larger the size of the layers, and more accurate
 * the model at the cost of speed. Set this to a smaller value to increase speed
 * at the cost of accuracy.
 * modelUrl: An optional string that specifies custom url of the model. This
 * is useful for area/countries that don't have access to the model hosted on
 * GCP.
 * quantBytes: An optional number with values: 1, 2, or 4. This parameter
 * affects weight quantization in the models. The available options are
 * 1 byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size
 * and thus the longer the loading time, the lower the value, the shorter the
 * loading time but lower the accuracy.
 * export interface ModelConfig {
 * architecture: BodyPixArchitecture;
 * outputStride: BodyPixOutputStride;
 * multiplier?: BodyPixMultiplier;
 * modelUrl?: string;
 * quantBytes?: BodyPixQuantBytes;
 * }
 * // The default configuration for loading MobileNetV1 based BodyPix.
 * // (And for references, the default configuration for loading ResNet based PoseNet is also included).
 * // const RESNET_CONFIG = {
 * // architecture: 'ResNet50',
 * // outputStride: 32,
 * // quantBytes: 4,
 * // } as ModelConfig;
 * // const MOBILENET_V1_CONFIG = {
 * // architecture: 'MobileNetV1',
 * // outputStride: 16,
 * // quantBytes: 4,
 * // multiplier: 0.75,
 * // } as ModelConfig;
 * // const VALID_ARCHITECTURE: BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];
 * // const VALID_STRIDE: { [id: string]: BodyPixOutputStride[] } = {
 * // 'MobileNetV1': [8, 16, 32],
 * // 'ResNet50': [32, 16]
 * // };
 * // const VALID_MULTIPLIER: { [id: string]: BodyPixMultiplier[] } = {
 * // 'MobileNetV1': [0.50, 0.75, 1.0],
 * // 'ResNet50': [1.0]
 * // };
 * // const VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];
 * // function validateModelConfig(config: ModelConfig): ModelConfig {
 * // config = config || MOBILENET_V1_CONFIG;
 * // if (config.architecture == null) {
 * // config.architecture = 'MobileNetV1';
 * // }
 * // if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {
 * // throw new Error(`Invalid architecture \${config.architecture}. ` +
 * // `Should be one of \${VALID_ARCHITECTURE}`);
 * // }
 * // if (config.outputStride == null) {
 * // config.outputStride = 16;
 * // }
 * // if (VALID_STRIDE[config.architecture].indexOf(config.outputStride) < 0) {
 * // throw new Error(`Invalid outputStride \${config.outputStride}. ` +
 * // `Should be one of \${VALID_STRIDE[config.architecture]} ` +
 * // `for architecture \${config.architecture}.`);
 * // }
 * // if (config.multiplier == null) {
 * // config.multiplier = 1.0;
 * // }
 * // if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {
 * // throw new Error(`Invalid multiplier \${config.multiplier}. ` +
 * // `Should be one of \${VALID_MULTIPLIER[config.architecture]} ` +
 * // `for architecture \${config.architecture}.`);
 * // }
 * // if (config.quantBytes == null) {
 * // config.quantBytes = 4;
 * // }
 * // if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {
 * // throw new Error(`Invalid quantBytes \${config.quantBytes}. ` +
 * // `Should be one of \${VALID_QUANT_BYTES} ` +
 * // `for architecture \${config.architecture}.`);
 * // }
 * // return config;
 * // }
 * // BodyPix inference is configurable using the following config dictionary.
 * // flipHorizontal: If the left-right keypoint of poses/part segmentation
 * // should be flipped/mirrored horizontally. This should be set to true for
 * // videos where the video is by default flipped horizontally (i.e. a webcam),
 * // and you want the person & body part segmentation to be returned in the proper
 * // orientation.
 * // internalResolution: Defaults to 'medium'. The internal resolution
 * // percentage that the input is resized to before inference. The larger the
 * // internalResolution the more accurate the model at the cost of slower
 * // prediction times. Available values are 'low', 'medium', 'high', 'full', or a
 * // percentage value between 0 and 1. The values 'low', 'medium', 'high', and
 * // 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
 * // segmentationThreshold: The minimum that segmentation values must
 * // have to be considered part of the person. Affects the generation of the
 * // segmentation mask. More specifically, it is the threshold

```

used to binarize the intermediate person segmentation probability. The probability of each pixel belongs to a
person is in range [0, 1]. If the probability is greater than the `segmentationThreshold`, it will be set to 1
otherwise 0.
*/
export interface InferenceConfig {
  flipHorizontal?: boolean;
  internalResolution?:
  BodyPixInternalResolution;
  segmentationThreshold?: number;
}
*/
**
* Person Inference Config
*
`maxDetections`: Defaults to 10. Maximum number of person pose detections per image.
*
`scoreThreshold`: Defaults to 0.4. Only return person pose that have root part score greater or equal to this
value.
*
* `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels. It needs to be
strictly positive. Two pose keypoints suppress each other if they are less than `nmsRadius` pixels away.
*/
export interface PersonInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?:
  number;
  nmsRadius?: number;
}
*/
**
* Multiple Person Instance Inference Config
*
* `maxDetections`:
Defaults to 10. Maximum number of returned instance segmentation and pose detections per image.
*
* `scoreThreshold`: Defaults to 0.4. Only returns and uses person poses for instance segmentation assignment
when the pose has root part score greater or equal to this value.
*
* `nmsRadius`: Defaults to 20. Non-
maximum suppression part distance in pixels. It needs to be strictly positive. Two parts suppress each other if
they are less than `nmsRadius` pixels away.
*
* `minKeypointScore`: Default to 0.3. Keypoints above the
score are used for matching and assigning segmentation mask to each person.
*
* `refineSteps`: Default to
10. The number of refinement steps used when assigning the instance segmentation. It needs to be strictly
positive. The larger the higher the accuracy and slower the inference.
*/
export interface
MultiPersonInstanceInferenceConfig
extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  minKeypointScore?: number;
  refineSteps?: number;
}
*/
export const PERSON_INFERENCE_CONFIG:
PersonInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold:
0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
};
*/
export const
MULTI_PERSON_INSTANCE_INFERENCE_CONFIG:
MultiPersonInstanceInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections:
10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10
};
*/
function validatePersonInferenceConfig(config: PersonInferenceConfig) {
  const { segmentationThreshold,
maxDetections, scoreThreshold, nmsRadius } =
config;
  if (segmentationThreshold < 0.0 ||
segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. ` +
`Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. ` +
`Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. ` +
`Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }
}
*/
function
validateMultiPersonInstanceInferenceConfig(config: MultiPersonInstanceInferenceConfig) {
  const {
segmentationThreshold,
maxDetections,
scoreThreshold,
nmsRadius,
minKeypointScore,
refineSteps
} = config;
  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new
Error(`segmentationThreshold ${segmentationThreshold}. ` +
`Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. ` +
`Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid
scoreThreshold ${scoreThreshold}. ` +
`Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }
  if (minKeypointScore < 0 || minKeypointScore > 1) {
    throw new Error(`Invalid minKeypointScore ${minKeypointScore}. ` +
`Should be in range [0.0, 1.0]`);
  }
  if (refineSteps <= 0 || refineSteps > 20) {
    throw new Error(`Invalid refineSteps
${refineSteps}. ` +
`Should be in range [1, 20]`);
  }
}
*/
export class BodyPix {
  baseModel:
BaseModel;
  constructor(net: BaseModel) {
    this.baseModel = net;
  }
  private
predictForPersonSegmentation(input: tf.Tensor3D): {
  segmentLogits: tf.Tensor3D,
  heatmapScores:
}
}

```

```

tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n }
{\n const {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n segmentLogits: tf.Tensor3D,\n partHeatmapLogits: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n } {\n const {\n segmentation,\n partHeatmaps,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n partHeatmapLogits: partHeatmaps,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n {\n segmentLogits: tf.Tensor3D,\n longOffsets: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n partHeatmaps: tf.Tensor3D,\n } {\n const {\n segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n partHeatmaps,\n } = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n partHeatmaps,\n };\n }\n\n /**\n * Given an image with people, returns a dictionary of all intermediate\n * tensors including: 1) a binary array with 1 for the pixels that are part of\n * the person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.\n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered part of the person. Affects the generation of the\n * segmentation mask.\n * @return A dictionary containing `segmentation`, `heatmapScores`, `offsets`,\n * and `padding`:\n * - `segmentation`: A 2d Tensor with 1 for the pixels that are part of the\n * person, and 0 otherwise. The width and height correspond to the same\n * dimensions of the input image.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * pose estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by pose\n * estimation decoding.\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used\n * by pose estimation decoding.\n * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by pose estimation decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n * before it is fed into the model.\n */\n segmentPersonActivation(\n input: BodyPixInput, internalResolution: BodyPixInternalResolution,\n segmentationThreshold = 0.5): {\n segmentation: tf.Tensor2D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n padding: Padding,\n internalResolutionHeightAndWidth: [number, number]\n } {\n const [height, width] = getInputSize(input);\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n internalResolution, this.baseModel.outputStride, [height, width]);\n const {resized, padding} =\n padAndResizeTo(input, internalResolutionHeightAndWidth);\n const {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } = tf.tidy(() => {\n const {\n segmentLogits,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } =\n this.predictForPersonSegmentation(resized);\n const [resizedHeight, resizedWidth] = resized.shape;\n const scaledSegmentScores = scaleAndCropToInputTensorShape(\n segmentLogits, [height, width], [resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n return {\n segmentation: toMaskTensor(\n tf.squeeze(scaledSegmentScores), segmentationThreshold),\n heatmapScores,\n offsets,\n }

```

```

displacementFwd,\n    displacementBwd,\n    });\n    });\n    resized.dispose();\n    return {\n    segmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n    });\n    }\n    }/**\n    * Given an image with many people, returns a
PersonSegmentation dictionary\n    * that contains the segmentation mask for all people and a single pose.\n    *\n    * Note: The segmentation mask returned by this method covers all people but\n    * the pose works well for one
person. If you want to estimate instance-level\n    * multiple person segmentation & pose for each person, use\n    *
`segmentMultiPerson` instead.\n    *\n    * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n
    * The input image to feed through the network.\n    *\n    * @param config PersonInferenceConfig object that
contains\n    * parameters for the BodyPix inference using person decoding.\n    *\n    * @return A
SemanticPersonSegmentation dictionary that contains height,\n    * width, the flattened binary segmentation mask
and the poses for all people.\n    * The width and height correspond to the same dimensions of the input image.\n    * -
`height`: The height of the segmentation data in pixel unit.\n    * - `width`: The width of the segmentation data in
pixel unit.\n    * - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel\n    * belongs to a person
and 0 means the pixel doesn't belong to a person. The\n    * size of the array is equal to `height` x `width` in row-
major order.\n    * - `allPoses`: The 2d poses of all people.\n    */\n    async segmentPerson(\n    input:
BodyPixInput,\n    config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):
Promise<SemanticPersonSegmentation> {\n    config = {...PERSON_INFERENCE_CONFIG, ...config};\n    \n    \n    validatePersonInferenceConfig(config);\n    \n    \n    const {\n    segmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n    } =\n    this.segmentPersonActivation(\n    input, config.internalResolution, config.segmentationThreshold);\n    \n    \n    const [height, width] = segmentation.shape;\n    \n    \n    const result = await segmentation.data() as Uint8Array;\n    \n    \n    segmentation.dispose();\n    \n    \n    const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScores, offsets,
displacementFwd, displacementBwd]);\n    \n    \n    const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =\n    tensorBuffers;\n    \n    \n    let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride, config.maxDetections,\n    config.scoreThreshold,
    config.nmsRadius);\n    \n    \n    poses = scaleAndFlipPoses(\n    poses, [height, width],
internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n    \n    \n    heatmapScores.dispose();\n    offsets.dispose();\n    displacementFwd.dispose();\n    displacementBwd.dispose();\n    \n    \n    return {height, width, data: result, allPoses: poses};\n    }\n    }\n    /**\n    * Given an image with multiple people, returns
an *array* of\n    * PersonSegmentation object. Each element in the array corresponding to one\n    * of the people in
the input image. In other words, it predicts\n    * instance-level multiple person segmentation & pose for each
person.\n    *\n    * The model does standard ImageNet pre-processing before inferring through\n    * the model. The
image pixels should have values [0-255].\n    *\n    * @param input\n    *
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n    * image to feed
through the network.\n    *\n    * @param config MultiPersonInferenceConfig
object that contains\n    * parameters for the BodyPix inference using multi-person decoding.\n    *\n    * @return An
array of PersonSegmentation object, each containing a width,\n    * height, a binary array (1 for the pixels that are
part of the\n    * person, and 0 otherwise) and 2D pose. The array size corresponds to the\n    * number of pixels in the
image. The width and height correspond to the\n    * dimensions of the image the binary array is shaped to, which are
the same\n    * dimensions of the input image.\n    */\n    async segmentMultiPerson(\n    input: BodyPixInput,\n    config: MultiPersonInstanceInferenceConfig =\n    MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):
Promise<PersonSegmentation[]> {\n    config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,
...config};\n    \n    \n    validateMultiPersonInstanceInferenceConfig(config);\n    \n    \n    const [height, width] =
getInputSize(input);\n    \n    \n    const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n    config.internalResolution, this.baseModel.outputStride,\n    [height, width]);\n    \n    \n    const {resized, padding} =\n    padAndResizeTo(input, internalResolutionHeightAndWidth);\n    \n    \n    const {\n    segmentation,\n    longOffsets,\n

```

```

heatmapScoresRaw,\n  offsetsRaw,\n  displacementFwdRaw,\n  displacementBwdRaw,\n  } = tf.tidy(() =>
{\n  const {\n  segmentLogits,\n  longOffsets,\n  heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd,\n  } =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n  const scaledSegmentScores =
scaleAndCropToInputTensorShape(\n  segmentLogits, [height, width], internalResolutionHeightAndWidth,\n  [[padding.top, padding.bottom], [padding.left, padding.right]],\n  APPLY_SIGMOID_ACTIVATION);\n  const longOffsetsResized = false;\n  let scaledLongOffsets;\n  if (longOffsetsResized) {\n  scaledLongOffsets = scaleAndCropToInputTensorShape(\n  longOffsets, [height, width], internalResolutionHeightAndWidth,\n  [[padding.top, padding.bottom], [padding.left, padding.right]],\n  APPLY_SIGMOID_ACTIVATION);\n  } else {\n  scaledLongOffsets = longOffsets;\n  }\n  const segmentation = toMaskTensor(\n  tf.squeeze(scaledSegmentScores),\n  config.segmentationThreshold);\n  return {\n  segmentation,\n  longOffsets: scaledLongOffsets,\n  heatmapScoresRaw: heatmapScores,\n  offsetsRaw: offsets,\n  displacementFwdRaw: displacementFwd,\n  displacementBwdRaw: displacementBwd,\n  };\n  });\n  const tensorBuffers = await toTensorBuffers3D(\n  [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf,\n  offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n  tensorBuffers;\n  let poses =\n  decodeMultiplePoses(\n  scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n  this.baseModel.outputStride, config.maxDetections,\n  config.scoreThreshold, config.nmsRadius);\n  poses = scaleAndFlipPoses(\n  poses, [height, width], internalResolutionHeightAndWidth, padding,\n  FLIP_POSES_AFTER_SCALING);\n  const instanceMasks = await decodePersonInstanceMasks(\n  segmentation, longOffsets, poses, height, width,\n  this.baseModel.outputStride,\n  internalResolutionHeightAndWidth, padding,\n  config.scoreThreshold, config.refineSteps,\n  config.minKeypointScore,\n  config.maxDetections);\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n  return instanceMasks;\n  }\n  /**\n  *
Given an image with many people, returns a dictionary containing: height,\n  * width, a tensor with a part id from 0-
24 for the pixels that are\n  * part of a
corresponding body part, and -1 otherwise. This does standard\n  * ImageNet pre-processing before inferring
through the model. The image\n  * should pixels should have values [0-255].\n  * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n  * The input image to feed
through the network.\n  * @param internalResolution Defaults to 'medium'. The internal resolution\n  *
percentage that the input is resized to before inference. The larger the\n  * internalResolution the more accurate the
model at the cost of slower\n  * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n  * a
percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n  * 'full' map to 0.25, 0.5, 0.75, and 1.0
correspondingly.\n  * @param segmentationThreshold The minimum that segmentation values must have\n  *
to be considered part of the person. Affects the clipping of the colored\n  * part image.\n  * @return A
dictionary
containing `partSegmentation`, `heatmapScores`,\n  * `offsets`, and `padding`:\n  * - `partSegmentation`: A 2d
Tensor with a part id from 0-24 for\n  * the pixels that are part of a corresponding body part, and -1 otherwise.\n  *
- `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n  * single-person pose estimation decoding.\n  *
- `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose\n  * estimation decoding.\n  *
- `displacementFwd`: A 3d Tensor of the keypoint forward displacement\n  * used by pose estimation decoding.\n  *
- `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n  * by pose estimation decoding.\n  *
- `padding`: The padding (unit pixels) being applied to the input image\n  * before it is fed into the model.\n  */\n  segmentPersonPartsActivation(\n  input: BodyPixInput, internalResolution: BodyPixInternalResolution,\n  segmentationThreshold = 0.5): {\n  partSegmentation: tf.Tensor2D,\n  heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd: tf.Tensor3D,\n  displacementBwd:
tf.Tensor3D,\n  padding: Padding,\n  internalResolutionHeightAndWidth: [number, number]\n  } {\n  const

```



```

[height, width] = getInputSize(input);\n  const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(\n    internalResolution, this.baseModel.outputStride, [height, width]);\n  const {\n    resized,\n    padding,\n  } = padAndResizeTo(input, internalResolutionHeightAndWidth);\n  const {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd\n  } =
tf.tidy(() => {\n    const {\n      segmentLogits,\n      partHeatmapLogits,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd\n    } = this.predictForPersonSegmentationAndPart(resized);\n    const [resizedHeight, resizedWidth] = resized.shape;\n    const scaledSegmentScores
= scaleAndCropToInputTensorShape(\n      segmentLogits, [height, width], [resizedHeight, resizedWidth],\n      [[padding.top, padding.bottom], [padding.left, padding.right]],\n      APPLY_SIGMOID_ACTIVATION);\n    const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(\n      partHeatmapLogits, [height, width],
[resizedHeight, resizedWidth],\n      [[padding.top, padding.bottom], [padding.left, padding.right]],\n      APPLY_SIGMOID_ACTIVATION);\n    const segmentation =\n    toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);\n    return {\n      partSegmentation:\n        decodePartSegmentation(segmentation, scaledPartHeatmapScore),\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n    };
  });\n  resized.dispose();\n  return {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n  };\n}

```

Given an image with many people, returns a PartSegmentation dictionary that contains the body part segmentation mask for all people and a single pose. Note: The body part segmentation mask returned by this method covers all people but the pose works well when there is one person. If you want to estimate instance-level multiple person body part segmentation & pose for each person, use `segmentMultiPersonParts` instead.

@param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement The input image to feed through the network.

@param config PersonInferenceConfig object that contains parameters for the BodyPix inference using single person decoding.

@return A SemanticPartSegmentation dictionary that contains height, width, the flattened binary segmentation mask and the pose for the person. The width and height correspond to

- `height`: The height of the person part segmentation data in pixel unit.
- `width`: The width of the person part segmentation data in pixel unit.
- `data`: The flattened Int32Array of person part segmentation data with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise. The size of the array is equal to `height` x `width` in row-major order.
- `allPoses`: The 2d poses of all people.

```

^/n async segmentPersonParts(\n  input: BodyPixInput,\n  config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n  Promise<SemanticPartSegmentation> {\n    config = {...PERSON_INFERENCE_CONFIG, ...config};\n    validatePersonInferenceConfig(config);\n    const {\n      partSegmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      padding,\n      internalResolutionHeightAndWidth\n    } =\n    this.segmentPersonPartsActivation(\n      input, config.internalResolution, config.segmentationThreshold);\n    const [height, width] = partSegmentation.shape;\n    const data = await partSegmentation.data() as Int32Array;\n    partSegmentation.dispose();\n    const tensorBuffers = await toTensorBuffers3D(\n      [heatmapScores, offsets, displacementFwd, displacementBwd]);\n    const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n      tensorBuffers;\n    let poses = decodeMultiplePoses(\n      scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n      this.baseModel.outputStride, config.maxDetections,\n      config.scoreThreshold, config.nmsRadius);\n    poses = scaleAndFlipPoses(\n      poses, [height, width], internalResolutionHeightAndWidth, padding,\n      FLIP_POSES_AFTER_SCALING);\n    heatmapScores.dispose();\n    offsets.dispose();\n    displacementFwd.dispose();\n    displacementBwd.dispose();\n    return {height, width, data,

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allPoses: poses};\n }\n\n /**\n * Given an image with multiple people, returns an *array* of PartSegmentation\n * object. Each element in the array corresponding to one\n * of the people in the input image. In other words, it\n predicts\n * instance-level multiple person body part segmentation & pose for each\n * person.\n *\n * This\n does standard ImageNet pre-processing before inferring through\n * the model. The image pixels should have\n values [0-255].\n *\n * @param input\n * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n * image to feed\n through the network.\n *\n * @param config MultiPersonInferenceConfig object that contains\n * parameters for\n the BodyPix inference using multi-person decoding.\n *\n * @return An array of PartSegmentation object, each\n containing a width,\n * height, a flattened array (with part id from 0-24 for the pixels that are\n * part of a\n corresponding body part, and -1 otherwise) and 2D pose.\n\n The width\n * and height correspond to the dimensions of the image. Each flattened part\n * segmentation array\n size is equal to `height` x `width`.\n */\n\n async segmentMultiPersonParts(\n  input: BodyPixInput,\n  config: MultiPersonInstanceInferenceConfig =\n    MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {\n  config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,\n    ...config};\n\n  validateMultiPersonInstanceInferenceConfig(config);\n  const [height, width] =\n    getInputSize(input);\n  const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n    config.internalResolution, this.baseModel.outputStride,\n    [height, width]);\n  const {resized, padding} =\n    padAndResizeTo(input, internalResolutionHeightAndWidth);\n  const {\n    segmentation,\n    longOffsets,\n    heatmapScoresRaw,\n    offsetsRaw,\n    displacementFwdRaw,\n    displacementBwdRaw,\n    partSegmentation,\n  } = tf.tidy(()\n    => {\n      const {\n        segmentLogits,\n        longOffsets,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n        partHeatmaps\n      } =\n        this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n\n      // decoding with scaling.\n      const scaledSegmentScores = scaleAndCropToInputTensorShape(\n        segmentLogits, [height, width],\n        internalResolutionHeightAndWidth,\n        [[padding.top, padding.bottom], [padding.left, padding.right]],\n        APPLY_SIGMOID_ACTIVATION);\n\n      // decoding with scaling.\n      const scaledPartSegmentationScores =\n        scaleAndCropToInputTensorShape(\n          partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n          [[padding.top, padding.bottom], [padding.left, padding.right]],\n          APPLY_SIGMOID_ACTIVATION);\n\n      const scaledLongOffsets = longOffsets;\n      const segmentation = toMaskTensor(\n        tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n\n      const partSegmentation =\n        decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n      return {\n        segmentation,\n        longOffsets: scaledLongOffsets,\n        heatmapScoresRaw: heatmapScores,\n        offsetsRaw: offsets,\n        displacementFwdRaw: displacementFwd,\n        displacementBwdRaw: displacementBwd,\n        partSegmentation\n      };\n    });\n\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf,\n    offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses =\n    decodeMultiplePoses(\n      scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n      this.baseModel.outputStride, config.maxDetections,\n      config.scoreThreshold, config.nmsRadius);\n\n  poses =\n    scaleAndFlipPoses(\n      poses, [height, width], internalResolutionHeightAndWidth, padding,\n      FLIP_POSES_AFTER_SCALING);\n\n  const instanceMasks = await decodePersonInstancePartMasks(\n    segmentation, longOffsets,\n    partSegmentation, poses, height, width,\n    this.baseModel.outputStride, internalResolutionHeightAndWidth,\n    padding,\n    config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n    config.maxDetections);\n\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n  partSegmentation.dispose();\n\n  return instanceMasks;\n }\n\n public\n dispose() {\n  this.baseModel.dispose();\n }\n\n /**\n * Loads the MobileNet BodyPix model.\n */\n\n async\n function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride = config.outputStride;\n
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const quantBytes = config.quantBytes;\n const multiplier = config.multiplier;\n if (tf == null) {\n  throw new
Error(\n    `Cannot
    find TensorFlow.js. If you are using a <script> tag, please ` +\n    `also include @tensorflow/tfjs on the page
before using this\n    model.`);\n };\n\n const url = mobileNetSavedModel(outputStride, multiplier,
quantBytes);\n const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n const mobilenet = new
MobileNet(graphModel, outputStride);\n return new BodyPix(mobilenet);\n }\n\n/**\n * Loads the ResNet BodyPix
model.\n */\n\nexport async function loadResNet(config: ModelConfig): Promise<BodyPix> {\n const outputStride =
config.outputStride;\n const quantBytes = config.quantBytes;\n if (tf == null) {\n  throw new Error(\n
`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n    `also include @tensorflow/tfjs on the
page before using this\n    model.`);\n };\n\n const url = resNet50SavedModel(outputStride, quantBytes);\n const
graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n const resnet = new ResNet(graphModel,
outputStride);\n return new BodyPix(resnet);\n }\n\n/**\n * Loads the BodyPix model instance from a checkpoint,
with the ResNet\n * or MobileNet architecture. The model to be loaded is configurable using the\n * config
dictionary ModelConfig. Please find more details in the\n * documentation of the ModelConfig.\n */\n\n * @param
config ModelConfig dictionary that contains parameters for\n * the BodyPix loading process. Please find more
details of each parameters\n * in the documentation of the ModelConfig interface. The predefined\n *
`MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n * for defining your
customized config.\n */\n\nexport async function load(config: ModelConfig = MOBILENET_V1_CONFIG):
Promise<BodyPix> {\n config = validateModelConfig(config);\n if (config.architecture === 'ResNet50') {\n
return loadResNet(config);\n } else if (config.architecture === 'MobileNetV1') {\n return
loadMobileNet(config);\n } else {\n return null;\n
}\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n\n*\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from
 './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}
from './util';\n\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst
offScreenCanvases: {[name: string]: Canvas} = {};\n\ntype ImageType =
HTMLImageElement|HTMLVideoElement|Canvas;\ntype HasDimensions = {\n width: number,\n height:
number\n};\n\nfunction isSafari() {\n return
(/^(?!chrome|android).*safari/i.test(navigator.userAgent));\n}\n\nfunction assertSameDimensions(\n {width:
widthA, height: heightA}: HasDimensions,\n {width: widthB, height: heightB}: HasDimensions, nameA: string,\n
nameB: string) {\n if (widthA !== widthB || heightA !== heightB) {\n throw new Error(`error: dimensions must
match. ${nameA} has dimensions ${\n widthA}x${heightA}, ${nameB} has dimensions
${widthB}x${heightB}`);\n }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n const ctx =
canvas.getContext('2d');\n ctx.scale(-1, 1);\n ctx.translate(-canvas.width, 0);\n}\n\nfunction
drawWithCompositing(\n ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n image:
Canvas|ImageType,\n compositeOperation:
string) {\n ctx.globalCompositeOperation = compositeOperation;\n ctx.drawImage(image, 0, 0);\n}\n\nfunction
createOffScreenCanvas(): Canvas {\n if (typeof document !== 'undefined') {\n return
document.createElement('canvas');\n } else if (typeof OffscreenCanvas !== 'undefined') {\n return new
OffscreenCanvas(0, 0);\n } else {\n throw new Error('Cannot create a canvas in this context');\n }\n}\n\nfunction
ensureOffscreenCanvasCreated(id: string): Canvas {\n if (!offScreenCanvases[id]) {\n offScreenCanvases[id] =
createOffScreenCanvas();\n }\n return offScreenCanvases[id];\n}\n\nfunction drawAndBlurImageOnCanvas(\n

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image: ImageType, blurAmount: number, canvas: Canvas) {\n  const {height, width} = image;\n  const ctx =
canvas.getContext('2d');\n  canvas.width = width;\n  canvas.height = height;\n  ctx.clearRect(0, 0, width, height);\n
ctx.save();\n  if (isSafari()) {\n    cpuBlur(canvas, image, blurAmount);\n  } else {\n    // tslint:disable:no-any\n
(ctx
as any).filter = `blur(${blurAmount}px)`;\n  ctx.drawImage(image, 0, 0, width, height);\n  }\n
ctx.restore();\n}\n\nfunction drawAndBlurImageOnOffScreenCanvas(\n  image: ImageType, blurAmount:
number,\n  offscreenCanvasName: string): Canvas {\n  const canvas =
ensureOffscreenCanvasCreated(offscreenCanvasName);\n  if (blurAmount === 0) {\n
renderImageToCanvas(image, canvas);\n  } else {\n    drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n
}\n  return canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n  const {width,
height} = image;\n  canvas.width = width;\n  canvas.height = height;\n  const ctx = canvas.getContext('2d');\n
ctx.drawImage(image, 0, 0, width, height);\n}\n\n/**\n * Draw an image on a canvas\n */\nfunction
renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n  canvas.width = image.width;\n  canvas.height
= image.height;\n  const ctx = canvas.getContext('2d');\n  ctx.putImageData(image, 0, 0);\n}\n\nfunction
renderImageDataToOffScreenCanvas(\n
  image: ImageData, canvasName: string): Canvas {\n  const canvas =
ensureOffscreenCanvasCreated(canvasName);\n  renderImageDataToCanvas(image, canvas);\n  return
canvas;\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image with
foreground and background color at each pixel determined by the\n * corresponding binary segmentation value at
the pixel from the output. In\n * other words, pixels where there is a person will be colored with foreground\n *
color and where there is not a person will be colored with background color.\n */\n * @param
personOrPartSegmentation The output from\n * `segmentPerson`, `segmentMultiPerson`,\n * `segmentPersonParts`
or `segmentMultiPersonParts`. They can\n * be SemanticPersonSegmentation object, an array of
PersonSegmentation object,\n * SemanticPartSegmentation object, or an array of PartSegmentation object.\n *
@param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground
color\n * (r,g,b,a) for visualizing pixels that belong to people.\n * @param background Default to {r:0, g:0, b:0,
a: 255}. The background color\n * (r,g,b,a) for visualizing pixels that don't belong to people.\n * @param
drawContour Default to false. Whether to draw the contour around each\n * person's segmentation mask or body
part mask.\n * @param foregroundIds Default to [1]. The integer values that represent\n * foreground. For
person segmentation, 1 is the foreground. For body part\n * segmentation, it can be a subset of all body parts ids.\n
*\n * @returns An ImageData with the same width and height of\n * all the PersonSegmentation in
multiPersonSegmentation, with opacity and\n * transparency at each pixel determined by the corresponding binary\n
* segmentation value at the pixel from the output.\n */\n\nexport function toMask(\n  personOrPartSegmentation:
SemanticPersonSegmentation|\n  SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n
  foreground:
  Color = {\n    r: 0,\n    g: 0,\n    b: 0,\n    a: 0\n  },\n  background: Color = {\n    r: 0,\n    g: 0,\n    b: 0,\n
    a: 255\n  },\n  drawContour = false, foregroundIds: number[] = [1]): ImageData {\n  if
(Array.isArray(personOrPartSegmentation) &&\n    personOrPartSegmentation.length === 0) {\n    return null;\n
}\n\n  let multiPersonOrPartSegmentation:\n    Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n
    PersonSegmentation|PartSegmentation>;\n\n  if (!Array.isArray(personOrPartSegmentation)) {\n
multiPersonOrPartSegmentation = [personOrPartSegmentation];\n  } else {\n    multiPersonOrPartSegmentation =
personOrPartSegmentation;\n  }\n\n  const {width, height} = multiPersonOrPartSegmentation[0];\n  const bytes =
new Uint8ClampedArray(width * height * 4);\n\n  function drawStroke(\n    bytes: Uint8ClampedArray, row:
number, column: number, width: number,\n    radius: number, color: Color = {r: 0, g: 255, b: 255, a:
255}) {\n    for (let i = -radius; i <= radius; i++) {\n      for (let j = -radius; j <= radius; j++) {\n        if (i !== 0 && j
!== 0) {\n          const n = (row + i) * width + (column + j);\n          bytes[4 * n + 0] = color.r;\n          bytes[4 * n +
1] = color.g;\n          bytes[4 * n + 2] = color.b;\n          bytes[4 * n + 3] = color.a;\n        }\n      }\n    }\n  }\n\n  function isSegmentationBoundary(\n    segmentationData: Uint8Array|Int32Array,\n    row: number,\n    column:

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number,\n width: number,\n foregroundIds: number[] = [1],\n radius = 1,\n ): boolean {\n let
numberBackgroundPixels = 0;\n for (let i = -radius; i <= radius; i++) {\n for (let j = -radius; j <= radius; j++)
{\n if (i !== 0 && j !== 0) {\n const n = (row + i) * width + (column + j);\n if
(!foregroundIds.some(id => id === segmentationData[n])) {\n numberBackgroundPixels += 1;\n }
}\n }\n }\n return
numberBackgroundPixels > 0;\n }\n\n for (let i = 0; i < height; i += 1) {\n for (let j = 0; j < width; j += 1) {\n
const n = i * width + j;\n bytes[4 * n + 0] = background.r;\n bytes[4 * n + 1] = background.g;\n bytes[4 * n
+ 2] = background.b;\n bytes[4 * n + 3] = background.a;\n for (let k = 0; k <
multiPersonOrPartSegmentation.length; k++) {\n if (foregroundIds.some(\n id => id ===
multiPersonOrPartSegmentation[k].data[n])) {\n bytes[4 * n] = foreground.r;\n bytes[4 * n + 1] =
foreground.g;\n bytes[4 * n + 2] = foreground.b;\n bytes[4 * n + 3] = foreground.a;\n const
isBoundary = isSegmentationBoundary(\n multiPersonOrPartSegmentation[k].data, i, j, width,\n
foregroundIds);\n if (drawContour && i - 1 >= 0 && i + 1 < height && j - 1 >= 0 &&\n j + 1 < width
&& isBoundary) {\n drawStroke(bytes, i, j, width, 1);\n }\n
}\n }\n }\n }\n\n return new ImageData(bytes, width, height);\n}\n\nconst
RAINBOW_PART_COLORS: Array<[number, number, number]> = [\n [110, 64, 170], [143, 61, 178], [178, 60,
178], [210, 62, 167],\n [238, 67, 149], [255, 78, 125], [255, 94, 99], [255, 115, 75],\n [255, 140, 56], [239, 167,
47], [217, 194, 49], [194, 219, 64],\n [175, 240, 91], [135, 245, 87], [96, 247, 96], [64, 243, 115],\n [40, 234, 141],
[28, 219, 169], [26, 199, 194], [33, 176, 213],\n [47, 150, 224], [65, 125, 224], [84, 101, 214], [99, 81,
195]\n];\n\n/**\n * Given the output from person body part segmentation (or multi-person\n * instance body part
segmentation) and an array of colors indexed by part id,\n * generates an image with the corresponding color for
each part at each pixel,\n * and white pixels where there is no part.\n *\n * @param partSegmentation The output
from segmentPersonParts\n * or segmentMultiPersonParts. The former is a SemanticPartSegmentation\n * object
and later is
an array of PartSegmentation object.\n *\n * @param partColors A multi-dimensional array of rgb colors indexed
by\n * part id. Must have 24 colors, one for every part.\n *\n * @returns An ImageData with the same width and
height of all the element in\n * multiPersonPartSegmentation, with the corresponding color for each part at\n * each
pixel, and black pixels where there is no part.\n */\n\nexport function toColoredPartMask(\n partSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n partColors: Array<[number, number, number]> =\n
RAINBOW_PART_COLORS): ImageData {\n if (Array.isArray(partSegmentation) && partSegmentation.length
=== 0) {\n return null;\n }\n\n let multiPersonPartSegmentation;\n if (!Array.isArray(partSegmentation)) {\n
multiPersonPartSegmentation = [partSegmentation];\n } else {\n multiPersonPartSegmentation =
partSegmentation;\n }\n\n const {width, height} = multiPersonPartSegmentation[0];\n const bytes = new
Uint8ClampedArray(width
* height * 4);\n\n for (let i = 0; i < height * width; ++i) {\n // invert mask. Invert the segmentation mask.\n
const j = i * 4;\n bytes[j + 0] = 255;\n bytes[j + 1] = 255;\n bytes[j + 2] = 255;\n bytes[j + 3] = 255;\n for
(let k = 0; k < multiPersonPartSegmentation.length; k++) {\n const partId =
multiPersonPartSegmentation[k].data[i];\n if (partId !== -1) {\n const color = partColors[partId];\n if
(!color) {\n throw new Error(`No color could be found for part id ${partId}`);\n }\n bytes[j + 0] =
color[0];\n bytes[j + 1] = color[1];\n bytes[j + 2] = color[2];\n bytes[j + 3] = 255;\n }\n }\n }\n\n return new ImageData(bytes, width, height);\n}\n\nconst CANVAS_NAMES = {\n blurred: 'blurred',\n
blurredMask: 'blurred-mask',\n mask: 'mask',\n lowresPartMask: 'lowres-part-mask',\n};\n\n/**\n * Given an image
and a maskImage of type ImageData, draws the image with the\n * mask on top of it
onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param image The original image to
apply the mask to.\n *\n * @param maskImage An ImageData containing the mask. Ideally this should be\n *
generated by toMask or toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask when drawing it
on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount How
many pixels to blur the mask by. Defaults to 0.\n *\n * Should be an integer between 0 and 20.\n *\n * @param

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flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n */\nexport function drawMask(\n
canvas: Canvas, image: ImageType, maskImage: ImageData|null,\n  maskOpacity = 0.7, maskBlurAmount = 0,\n  flipHorizontal = false) {\n  const [height, width] = getInputSize(image);\n  canvas.width = width;\n  canvas.height =\n  height;\n\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n\n  ctx.drawImage(image, 0, 0);\n  ctx.globalAlpha = maskOpacity;\n  if (maskImage) {\n    assertSameDimensions({width, height}, maskImage, 'image', 'mask');\n    const mask =\n    renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n    const blurredMask =\n    drawAndBlurImageOnOffScreenCanvas(\n      mask, maskBlurAmount, CANVAS_NAMES.blurredMask);\n\n    ctx.drawImage(blurredMask, 0, 0, width, height);\n  }\n  ctx.restore();\n}\n\n/**\n * Given an image and a\n * maskImage of type ImageData, draws the image with the\n * pixelated mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the mask. Ideally this should be\n * generated by\n * toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount\n * How many pixels to blur the mask by. Defaults to 0.\n *\n * Should be an integer between 0 and 20.\n *\n * @param\n * flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n *\n * @param pixelCellWidth\n * The width of each pixel cell. Default to 10 px.\n */\nexport function drawPixelatedMask(\n  canvas: Canvas,\n  image: ImageType, maskImage: ImageData,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n  pixelCellWidth = 10.0) {\n  const [height, width] = getInputSize(image);\n  assertSameDimensions({width, height},\n  maskImage, 'image', 'mask');\n\n  const mask = renderImageDataToOffScreenCanvas(maskImage,\n  CANVAS_NAMES.mask);\n  const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n  mask,\n  maskBlurAmount, CANVAS_NAMES.blurredMask);\n\n  canvas.width = blurredMask.width;\n  canvas.height =\n  blurredMask.height;\n\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n\n  const offscreenCanvas\n  =\n  ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n  const offscreenCanvasCtx =\n  offscreenCanvas.getContext('2d');\n  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n  offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n  offscreenCanvasCtx.drawImage(\n  blurredMask, 0, 0, blurredMask.width, blurredMask.height, 0, 0,\n  offscreenCanvas.width,\n  offscreenCanvas.height);\n  ctx.imageSmoothingEnabled = false;\n  ctx.drawImage(\n  offscreenCanvas, 0, 0,\n  offscreenCanvas.width, offscreenCanvas.height, 0,\n  0, canvas.width, canvas.height);\n\n  // Draws vertical grid\n  lines that are `pixelCellWidth` apart from each other.\n  for (let i = 0; i < offscreenCanvas.width; i++) {\n    ctx.beginPath();\n    ctx.strokeStyle = '#ffffff';\n    ctx.moveTo(pixelCellWidth * i, 0);\n    ctx.lineTo(pixelCellWidth\n * i, canvas.height);\n    ctx.stroke();\n  }\n\n  // Draws horizontal grid lines that are `pixelCellWidth`\n  apart\n  from each\n  // other.\n  for (let i = 0; i < offscreenCanvas.height; i++) {\n    ctx.beginPath();\n    ctx.strokeStyle =\n  '#ffffff';\n    ctx.moveTo(0, pixelCellWidth * i);\n    ctx.lineTo(canvas.width, pixelCellWidth * i);\n    ctx.stroke();\n  }\n\n  ctx.globalAlpha = 1.0 - maskOpacity;\n  ctx.drawImage(image, 0, 0, blurredMask.width,\n  blurredMask.height);\n  ctx.restore();\n}\n\nfunction createPersonMask(\n  multiPersonSegmentation:\n  PersonSegmentation[]|SemanticPersonSegmentation,\n  edgeBlurAmount: number): Canvas {\n  const\n  backgroundMaskImage = toMask(\n  multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n  {r: 0, g: 0, b: 0, a:\n  0});\n  const backgroundMask =\n  renderImageDataToOffScreenCanvas(backgroundMaskImage,\n  CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n    return backgroundMask;\n  } else {\n    return\n    drawAndBlurImageOnOffScreenCanvas(\n      backgroundMask, edgeBlurAmount,\n      CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation\n * and an image, draws the image with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas\n * to draw the background-blurred image onto.\n *\n * @param image The image to blur the background of and\n * draw.\n *\n * @param personSegmentation A SemanticPersonSegmentation or an array of\n * PersonSegmentation\n * object.\n *\n * @param backgroundBlurAmount How many pixels in the background blend into each\n * other.

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Defaults to 3. Should be an integer between 1 and 20.\n * \n * @param edgeBlurAmount How many pixels to blur
on the edge between the person\n * and the background by. Defaults to 3. Should be an integer between 0 and 20.\n
*\n * @param flipHorizontal If the output should be flipped horizontally. Defaults\n * to false.\n */\nexport
function drawBokehEffect(\n canvas: Canvas, image: ImageType,\n multiPersonSegmentation:
SemanticPersonSegmentation|PersonSegmentation[],\n backgroundBlurAmount = 3, edgeBlurAmount = 3,
flipHorizontal = false) {\n const blurredImage
= drawAndBlurImageOnOffScreenCanvas(\n image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n
canvas.width = blurredImage.width;\n canvas.height = blurredImage.height;\n\n const ctx =
canvas.getContext('2d');\n\n if (Array.isArray(multiPersonSegmentation) &&\n multiPersonSegmentation.length
=== 0) {\n ctx.drawImage(blurredImage, 0, 0);\n return;\n }\n\n const personMask =
createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n\n ctx.save();\n if (flipHorizontal) {\n
flipCanvasHorizontal(canvas);\n }\n // draw the original image on the final canvas\n const [height, width] =
getInputSize(image);\n ctx.drawImage(image, 0, 0, width, height);\n\n // \"destination-in\" - \"The existing canvas
content is kept where both the\n // new shape and existing canvas content overlap. Everything else is made\n //
transparent.\"\n // crop what's not the person using the mask from the original image\n drawWithCompositing(ctx,
personMask, 'destination-in');\n
// \"destination-over\" - \"The existing canvas content is kept where both the\n // new shape and existing canvas
content overlap. Everything else is made\n // transparent.\"\n // draw the blurred background on top of the original
image where it doesn't\n // overlap.\n drawWithCompositing(ctx, blurredImage, 'destination-over');\n
ctx.restore();\n}\n\nfunction createBodyPartMask(\n multiPersonPartSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n bodyPartIdsToMask: number[], edgeBlurAmount: number):
Canvas {\n const backgroundMaskImage = toMask(\n multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},\n
{r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);\n\n const backgroundMask =\n
renderImageDataToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask);\n\n if (edgeBlurAmount
=== 0) {\n return backgroundMask;\n } else {\n return drawAndBlurImageOnOffScreenCanvas(\n
backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask);\n
}\n}\n\n/**\n * Given a personSegmentation and an image, draws the image with its background\n * blurred onto
the canvas.\n * \n * @param canvas The canvas to draw the background-blurred image onto.\n * \n * @param image
The image to blur the background of and draw.\n * \n * @param partSegmentation A SemanticPartSegmentation or
an array of\n * PartSegmentation object.\n * \n * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-
face). An\n * array of body part ids to blur. Each must be one of the 24 body part ids.\n * \n * @param
backgroundBlurAmount How many pixels in the background blend into each\n * other. Defaults to 3. Should be an
integer between 1 and 20.\n * \n * @param edgeBlurAmount How many pixels to blur on the edge between the
person\n * and the background by. Defaults to 3. Should be an integer between 0 and 20.\n * \n * @param
flipHorizontal If the output should be flipped horizontally. Defaults\n * to false.\n */\nexport function
blurBodyPart(\n canvas: Canvas,
image: ImageType,\n partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n bodyPartIdsToBlur =
[0, 1], backgroundBlurAmount = 3, edgeBlurAmount = 3,\n flipHorizontal = false) {\n const blurredImage =
drawAndBlurImageOnOffScreenCanvas(\n image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n
canvas.width = blurredImage.width;\n canvas.height = blurredImage.height;\n\n const ctx =
canvas.getContext('2d');\n\n if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n
ctx.drawImage(blurredImage, 0, 0);\n return;\n }\n\n const bodyPartMask =\n
createBodyPartMask(partSegmentation, bodyPartIdsToBlur, edgeBlurAmount);\n\n ctx.save();\n if (flipHorizontal)
{\n flipCanvasHorizontal(canvas);\n }\n // draw the original image on the final canvas\n const [height, width] =
getInputSize(image);\n ctx.drawImage(image, 0, 0, width, height);\n\n // \"destination-in\" - \"The existing canvas
content is kept where both the\n // new shape
and existing canvas content overlap. Everything else is made\n // transparent.\"\n // crop what's not the person
using the mask from the original image\n drawWithCompositing(ctx, bodyPartMask, 'destination-in');\n //

```

```
"destination-over" - "The existing canvas content is kept where both the // new shape and existing canvas content overlap. Everything else is made // transparent." // draw the blurred background on top of the original image where it doesn't // overlap.
drawWithCompositing(ctx, blurredImage, 'destination-over');
ctx.restore();
}
}
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```

```
=====
// method copied from bGlu in https://codepen.io/zhaojun/pen/zZmRQe
export function cpuBlur(
  canvas: HTMLCanvasElement|OffscreenCanvas,
  image:
  HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,
  blur: number) {
  const ctx = canvas.getContext('2d');
  let sum = 0;
  const delta = 5;
  const alphaLeft = 1 / (2 * Math.PI * delta * delta);
  const step = blur < 3 ? 1 : 2;
  for (let y = -blur; y <= blur; y += step) {
    for (let x = -blur; x <= blur; x += step) {
      const weight = alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));
      sum += weight;
    }
  }
  for (let y = -blur; y <= blur; y += step) {
    for (let x = -blur; x <= blur; x += step) {
      ctx.globalAlpha = alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;
      ctx.drawImage(image, x, y);
    }
  }
  ctx.globalAlpha = 1;
}
}
/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.

```

```
=====
export const PART_CHANNELS: string[] = [
  'left_face',
  'right_face',
  'left_upper_arm_front',
  'left_upper_arm_back',
  'right_upper_arm_front',
  'right_upper_arm_back',
  'left_lower_arm_front',
  'left_lower_arm_back',
  'right_lower_arm_front',
  'right_lower_arm_back',
  'left_hand',
  'right_hand',
  'torso_front',
  'torso_back',
  'left_upper_leg_front',
  'left_upper_leg_back',
  'right_upper_leg_front',
  'right_upper_leg_back',
  'left_lower_leg_front',
  'left_lower_leg_back',
  'right_lower_leg_front',
  'right_lower_leg_back',
  'left_feet',
  'right_feet'];
}
}
/**
 * @license See the LICENSE file.
 * This code is auto-generated, do not modify this file!
const version = '2.2.0';
export {
  version,
  names: [
    'toFlattenedOneHotPartMap',
    'partHeatmapScores',
    'numParts',
    'shape',
    'partMapLocations',
    'tf.argmax',
    'partMapFlattened',
    'tf.reshape',
    'tf.oneHot',
    'toMaskTensor',
    'segmentScores',
    'threshold',
    'tf.tidy',
    'tf.cast',
    'tf.greater',
    'tf.scalar',
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    'segmentationMask',
    '_a',
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    '_this',
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    'asBatch',
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    'y',
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    'NUM_KEYPOINTS',
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    'padding',
    'height',
    'width',
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    'inputResolutionX',
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    'x',
    'keypoint',
    'get',
    'getImageCoords',
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    'clamp',
    'a',
    'min',
    'max',
    'addVectors',
    'b',
    'computeDistance',
    'embedding',
    'pose',
    'minPartScore',
    'distance',
    'numKpt',
    'p',
    'keypoints',
    'score',
    'Math',
    'position',
    'Infinity',
    'getEmbedding',
    'location',
    'keypointIndex',
    'convertToPosition',
    'outputRes

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 *
 * =====
 */
```

Found in path(s):

```
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/util_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/util_test.d.ts
*
/opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/body_pix_test.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/single_person/argmax2d_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/body_pix_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/single_person/argmax2d_test.d.ts
```

No license file was found, but licenses were detected in source scan.

```
{"version":3,"file":"body-
```

pix.esm.js", "sources": ["../src/decode_part_map.ts", "../src/base_model.ts", "../src/mobilenet.ts", "../src/keypoints.ts", "../src/multi_person/util.ts", "../src/multi_person/decode_multiple_masks_cpu.ts", "../src/multi_person/decode_multiple_masks_webgl.ts", "../src/multi_person/decode_instance_masks.ts", "../src/multi_person/max_heap.ts", "../src/multi_person/build_part_with_score_queue.ts", "../src/multi_person/decode_pose.ts", "../src/multi_person/decode_multiple_poses.ts", "../src/resnet.ts", "../src/saved_models.ts", "../src/util.ts", "../src/body_pix_model.ts", "../src/blur.ts", "../src/output_rendering_util.ts", "../src/part_channels.ts", "../src/version.ts"], "sourcesContent": ["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```
=====
import * as tf from '@tensorflow/tfjs-core';

/**
 * Takes the sigmoid of the part heatmap output and generates a 2d one-hot tensor with ones where the part's score has the maximum value.
 * @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap output.
 * @return A 2d one-hot tensor with ones where the part's score has the maximum value.
 */
function toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
  const numParts = partHeatmapScores.shape[2];
  const partMapLocations = tf.argmax(partHeatmapScores, 2);
  const partMapFlattened = tf.reshape(partMapLocations, [-1]);
  return tf.oneHot(partMapFlattened, numParts) as tf.Tensor2D;
}

/**
 * Takes the sigmoid of the segmentation output, and generates a segmentation mask with a 1 or 0 at each pixel where there is a person or not a person. The segmentation threshold determines the threshold of a score for a pixel for it to be considered part of a person.
 * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.
 * @param segmentationThreshold The minimum that segmentation values must have to be considered part of the person. Affects the generation of the segmentation mask and the clipping of the colored part image.
 * @return A segmentation mask with a 1 or 0 at each pixel where there is a person or not a person.
 */
export function toMaskTensor(segmentScores: tf.Tensor2D, threshold: number): tf.Tensor2D {
  return tf.tidy(() => (tf.cast(tf.greater(segmentScores, tf.scalar(threshold)), 'int32') as tf.Tensor2D));
}

/**
 * Takes the sigmoid of the person and part map output, and returns a 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped by the segmentation mask. Wherever the a pixel is clipped by the segmentation mask, its value will set to -1, indicating that there is no part in that pixel.
 * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.
 * @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap output.
 * @return A 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped by the segmentation mask. It will have values of -1 for pixels that are outside of the body and do not have a corresponding part.
 */
export function decodePartSegmentation(segmentationMask: tf.Tensor2D, partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
  const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
  return tf.tidy(() => {
    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
    const partMapFlattened = tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
    const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);
    const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));
    return tf.sub(clipByMask2d(partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask), tf.scalar(1, 'int32'));
  });
}

/**
 * Takes the sigmoid of the person and part map output, and returns a 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped by the segmentation mask. It will have values of -1 for pixels that are outside of the body and do not have a corresponding part.
 */
export function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
  const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
  return tf.tidy(() => {
    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
    const partMapFlattened =

```

```

tf.cast(tf.matMul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');\n\n  return tf.reshape(partMapFlattened,
[partMapHeight, partMapWidth]);\n  });\n  }\n  },"/n/**\n * @license\n * Copyright 2019 Google Inc. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n
* limitations under the License.\n */
=====\n
*/\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport
{BodyPixOutputStride} from './types';\n\n/**\n * BodyPix supports using various convolution neural network
models\n * (e.g. ResNet and MobileNetV1) as its underlying base model.\n * The following BaseModel interface
defines a unified interface for\n * creating such BodyPix base models. Currently both MobileNet (in\n *
./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel\n * interface. New base models that conform
to the BaseModel interface can be\n * added to BodyPix.\n */\n\nexport abstract class BaseModel {\n  constructor(\n
protected readonly model: tfconv.GraphModel,\n    public readonly outputStride: BodyPixOutputStride) {\n
const inputShape =\n    this.model.inputs[0].shape as [number, number, number, number];\n    tf.util.assert(\n
(inputShape[1] === -1) && (inputShape[2] === -1),\n      () => `Input shape [${inputShape[1]},
${inputShape[2]}]` +\n      ` must both be equal to or -1`);\n  }\n\n  abstract preprocessInput(input: tf.Tensor3D):
tf.Tensor3D;\n\n  /**\n   * Predicts intermediate Tensor representations.\n   * @param input The input RGB
image of the base model.\n   * A Tensor of shape: [inputResolution, inputResolution, 3].\n   * @return A
dictionary of base model's intermediate predictions.\n   * The returned dictionary should contains the following
elements:\n   * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.\n   * - offsets: A
Tensor3D that represents the offsets.\n   * - displacementFwd: A Tensor3D that represents the forward
displacement.\n   * - displacementBwd: A Tensor3D that represents the backward displacement.\n   * -
segmentation: A Tensor3D that represents the segmentation of all\n   * people.\n   * - longOffsets: A Tensor3D
that represents the long offsets used for\n   * instance grouping.\n   * - partHeatmaps: A Tensor3D that represents
the body part segmentation.\n   */\n  predict(input: tf.Tensor3D): {\n    heatmapScores: tf.Tensor3D,\n    offsets:
tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation:
tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets: tf.Tensor3D\n  } \n
return tf.tidy(() => {\n    const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n    const asBatch =
tf.expandDims(asFloat, 0);\n    const results = this.model.predict(asBatch) as tf.Tensor4D[];\n    const results3d:
tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n    const namedResults =
this.nameOutputResults(results3d);\n\n    return {\n      heatmapScores: tf.sigmoid(namedResults.heatmap),\n
offsets: namedResults.offsets,\n      displacementFwd: namedResults.displacementFwd,\n      displacementBwd:
namedResults.displacementBwd,\n      segmentation: namedResults.segmentation,\n      partHeatmaps:
namedResults.partHeatmaps,\n      longOffsets: namedResults.longOffsets,\n      partOffsets:
namedResults.partOffsets\n    };\n  });\n  }\n\n  // Because MobileNet and ResNet predict() methods output a
different order for\n  // these values, we have a method that needs to be implemented to order them.\n  abstract
nameOutputResults(results: tf.Tensor3D[]): {\n    heatmap: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n
displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation: tf.Tensor3D,\n
partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets: tf.Tensor3D\n  }; \n\n  /**\n   * Releases
the CPU and GPU memory allocated by the model.\n   */\n  dispose() {\n    this.model.dispose();\n  }\n}\n\n"/n/**\n *
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```
=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport { BaseModel } from './base_model';\nexport class MobileNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    // Normalize the pixels [0, 255] to be between [-1, 1].\n    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n  }\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets,\n    ] = results;\n    return {\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    }; }\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nexport type Tuple<T> = [T, T];\nexport type StringTuple = Tuple<string>;\nexport type NumberTuple = Tuple<number>;\nexport const PART_NAMES = [\n  'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',\n  'leftShoulder', 'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n  'leftHip', 'rightHip', 'leftKnee', 'rightKnee', 'leftAnkle', 'rightAnkle'\n];\nexport const NUM_KEYPOINTS = PART_NAMES.length;\nexport interface NumberDict {\n  [jointName: string]: number;\n}\nexport const PART_IDS = PART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n  result[jointName] = i;\n  return result;\n}, {});\nconst CONNECTED_PART_NAMES: StringTuple[] = [\n  ['leftHip', 'leftShoulder'],\n  ['leftElbow', 'leftShoulder'],\n  ['leftElbow', 'leftWrist'],\n  ['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'],\n  ['rightHip', 'rightShoulder'],\n  ['rightElbow', 'rightShoulder'],\n  ['rightElbow', 'rightWrist'],\n  ['rightHip', 'rightKnee'],\n  ['rightKnee', 'rightAnkle'],\n  ['leftShoulder', 'rightShoulder'],\n  ['leftHip', 'rightHip']\n];\n/*\n * Define the skeleton. This defines the parent->child relationships of our\n * tree. Arbitrarily this defines the nose as the root of the tree, however\n * since we will infer the displacement for both parent->child and\n * child->parent, we can define the tree root as any node.\n */\nexport const POSE_CHAIN: StringTuple[] = [\n  ['nose', 'leftEye'],\n  ['leftEye', 'leftEar'],\n  ['nose', 'rightEye'],\n  ['rightEye', 'rightEar'],\n  ['nose', 'leftShoulder'],\n  ['leftShoulder', 'leftElbow'],\n  ['leftElbow', 'leftWrist'],\n  ['leftShoulder', 'leftHip'],\n  ['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'],\n  ['nose', 'rightShoulder'],\n  ['rightShoulder', 'rightElbow'],\n  ['rightElbow', 'rightWrist'],\n  ['rightShoulder', 'rightHip'],\n  ['rightHip', 'rightKnee'],\n  ['rightKnee', 'rightAnkle']\n];\nexport const CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(\n  ([jointNameA, jointNameB]) => (\n    [PART_IDS[jointNameA], PART_IDS[jointNameB]]\n  ));\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { NUM_KEYPOINTS } from './keypoints';\nimport { Padding, Part, TensorBuffer3D, Vector2D } from './types';\nexport function getScale(\n  [height, width]: [number, number],\n  [inputResolutionY, inputResolutionX]: [number, number],\n  padding: Padding): [number, number] {\n  const { top: padT, bottom: padB, left: padL, right: padR } = padding;\n  const scaleY = inputResolutionY / (padT
```

```

+ padB + height);\n const scaleX = inputResolutionX / (padL + padR + width);\n return [scaleX,
scaleY];\n}\n\nexport function getOffsetPoint(\n y: number, x: number, keypoint: number, offsets:
TensorBuffer3D): Vector2D {\n return {\n y: offsets.get(y, x, keypoint),\n x: offsets.get(y, x, keypoint +
NUM_KEYPOINTS)\n };\n}\n\nexport function getImageCoords(\n part: Part, outputStride: number, offsets:
TensorBuffer3D): Vector2D {\n const {heatmapY, heatmapX, id: keypoint} = part;\n const {y, x} =
getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n return {\n x: part.heatmapX * outputStride + x,\n y:
part.heatmapY * outputStride + y\n };\n}\n\nexport function fillArray<T>(element: T, size: number): T[] {\n const
result: T[] = new Array(size);\n\n for (let i = 0; i < size; i++) {\n result[i] = element;\n }\n\n return result;\n}\n\nexport function clamp(a: number,
min: number, max: number): number {\n if (a < min) {\n return min;\n }\n if (a > max) {\n return max;\n }\n
return a;\n}\n\nexport function squaredDistance(\n y1: number, x1: number, y2: number, x2: number): number {\n
const dy = y2 - y1;\n const dx = x2 - x1;\n return dy * dy + dx * dx;\n}\n\nexport function addVectors(a:
Vector2D, b: Vector2D): Vector2D {\n return {x: a.x + b.x, y: a.y + b.y};\n}\n\nexport function clampVector(a:
Vector2D, min: number, max: number): Vector2D {\n return {y: clamp(a.y, min, max), x: clamp(a.x, min,
max)};\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose} from './types';\nimport
{getScale} from './util';\n\ninterface Pair {\n x: number;\n y: number;\n}\n\nfunction computeDistance(embedding:
Pair[], pose: Pose, minPartScore = 0.3) {\n let distance = 0.0;\n let numKpt = 0;\n for (let p = 0; p <
embedding.length; p++) {\n if (pose.keypoints[p].score > minPartScore) {\n numKpt += 1;\n distance +=
(embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n (embedding[p].y - pose.keypoints[p].position.y) **
2;\n }\n }\n\n if (numKpt === 0) {\n distance = Infinity;\n } else {\n distance = distance / numKpt;\n }\n return
distance;\n}\n\nfunction convertToPositionInOutput(\n position: Pair, [padT, padL]: [number, number],\n [scaleX,
scaleY]: [number, number], stride: number): Pair {\n const y = Math.round(((padT + position.y + 1.0) *
scaleY - 1.0) / stride);\n const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n return {x,
y};\n}\n\nfunction getEmbedding(\n location: Pair, keypointIndex: number,\n convertToPosition: (pair: Pair) =>
Pair, outputResolutionX: number,\n longOffsets: Float32Array, refineSteps: number,\n [height, width]: [number,
number]): Pair {\n const newLocation = convertToPosition(location);\n const nn = newLocation.y *
outputResolutionX + newLocation.x;\n let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n let
dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n let y = location.y + dy;\n let x =
location.x
+ dx;\n for (let t = 0; t < refineSteps; t++) {\n y = Math.min(y, height - 1);\n x = Math.min(x, width - 1);\n
const newPos = convertToPosition({x, y});\n const nn = newPos.y * outputResolutionX + newPos.x;\n dy =
longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n dx = longOffsets[NUM_KEYPOINTS * (2 * nn
+ 1) + keypointIndex];\n y = y + dy;\n x = x + dx;\n }\n\n return {x, y};\n}\n\nfunction
matchEmbeddingToInstance(\n location: Pair, longOffsets: Float32Array, poses: Pose[],\n numKptForMatching:
number, [padT, padL]: [number, number],\n [scaleX, scaleY]: [number, number], outputResolutionX: number,\n
[height, width]: [number, number], stride: number,\n refineSteps: number): number {\n const embed: Pair[] = [];\n
const convertToPosition = (pair: Pair) =>\n convertToPositionInOutput(pair, [padT, padL], [scaleX, scaleY],
stride);\n\n for (let keypointsIndex = 0; keypointsIndex < numKptForMatching;\n keypointsIndex++) {\n

```



```

= new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);
for (let i = 0; i <
posesAboveScore.length; i++) {
  const poseOffset = i * NUM_KEYPOINTS * 3;
  const pose =
posesAboveScore[i];
  for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {
    const keypoint =
pose.keypoints[kp];
    const offset = poseOffset + kp * 3;
    poseVals[offset] = keypoint.score;
    poseVals[offset + 1] = keypoint.position.y;
    poseVals[offset + 2] = keypoint.position.x;
  }
}
const
[scaleX, scaleY] =
  getScale([height, width], [inHeight, inWidth], padding);
const posesTensor =
tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);
const {top: padT, left: padL} = padding;
const program: tf_webgl.GPGPUProgram = {
  variableNames: ['segmentation', 'longOffsets', 'poses'],
  outputShape: [origHeight, origWidth],
  userCode: `
int convertToPositionInOutput(int pos, int pad, float
scale, int stride) {
  return round(((float(pos +
pad) + 1.0) * scale - 1.0) / float(stride));
}
float convertToPositionInOutputFloat(int pos, int pad,
float scale, int stride) {
  return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);
}
float dist(float
x1, float y1, float x2, float y2) {
  return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);
}
float
sampleLongOffsets(float h, float w, int d, int k) {
  float fh = fract(h);
  float fw = fract(w);
  int c1H =
int(ceil(h));
  int c1W = int(ceil(w));
  int f1H = int(floor(h));
  int f1W = int(floor(w));
  float o11 =
getLongOffsets(f1H, f1W, d, k);
  float o12 = getLongOffsets(f1H, c1W, d, k);
  float o21 =
getLongOffsets(c1H, f1W, d, k);
  float o22 = getLongOffsets(c1H, c1W, d, k);
  float o1 = mix(o11, o12,
fw);
  float o2 = mix(o21, o22, fw);
  return mix(o1, o2, fh);
}
int findNearestPose(int h, int w) {
  float prob = getSegmentation(h, w);
  if (prob < 1.0) {
    return -1;
  }
  // Done(Tyler): convert from output space h/w to strided space.
  float stridedH = convertToPositionInOutputFloat(h, ${padT}, ${scaleY}, ${stride});
  float stridedW =
convertToPositionInOutputFloat(w, ${padL}, ${scaleX}, ${stride});
  float minDist = 1000000.0;
  int iMin = -1;
  for (int i = 0; i < ${maxNumPeople}; i++) {
    float curDistSum = 0.0;
    int numKpt =
0;
    for (int k = 0; k < ${NUM_KEYPOINTS}; k++) {
      float dy = sampleLongOffsets(stridedH,
stridedW, 0, k);
      float dx = sampleLongOffsets(stridedH, stridedW, 1, k);
      float y = float(h) + dy;
      float x = float(w) + dx;
      for (int s = 0; s < ${refineSteps}; s++) {
        int yRounded = round(min(y,
float(${height} - 1.0)));
        int xRounded = round(min(x, float(${width} - 1.0)));
        float yStrided =
convertToPositionInOutputFloat(
          yRounded, ${padT}, ${scaleY}, ${stride});
        float xStrided = convertToPositionInOutputFloat(
          xRounded, ${padL}, ${scaleX}, ${stride});
        float dy = sampleLongOffsets(yStrided, xStrided, 0,
k);
        float dx = sampleLongOffsets(yStrided, xStrided, 1, k);
        y = y + dy;
        x = x + dx;
      }
      float poseScore = getPoses(i, k, 0);
      float poseY = getPoses(i, k, 1);
      float poseX =
getPoses(i, k, 2);
      if (poseScore > ${minKptScore}) {
        numKpt = numKpt + 1;
        curDistSum
= curDistSum + dist(x, y, poseX, poseY);
      }
    }
    if (numKpt > 0 && curDistSum / float(numKpt) <
minDist) {
      minDist = curDistSum / float(numKpt);
      iMin = i;
    }
  }
  return iMin;
}
void main() {
  ivec2 coords = getOutputCoords();
  int nearestPose = findNearestPose(coords[0],
coords[1]);
  setOutput(float(nearestPose));
}
const webglBackend = tf.backend() as
tf_webgl.MathBackendWebGL;
return webglBackend.compileAndRun(program, [segmentation,
shapedLongOffsets, posesTensor]);
*/
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*/
=====
*/
import * as tf from '@tensorflow/tfjs-core';
import

```

```

{getBackend} from '@tensorflow/tfjs-core';\n\nimport {Padding, PartSegmentation, PersonSegmentation, Pose}
from './types';\n\nimport {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from
'./decode_multiple_masks_cpu';\nimport {decodeMultipleMasksWebGl} from
'./decode_multiple_masks_webgl';\n\nexport function toPersonKSegmentation(\n  segmentation: tf.Tensor2D, k:
number): tf.Tensor2D {\n  return tf.tidy(\n    () => (tf.cast(tf.equal(\n      segmentation, tf.scalar(k), 'int32') as
tf.Tensor2D));\n  )\n}\n\nexport function toPersonKPartSegmentation(\n  segmentation: tf.Tensor2D, bodyParts:
tf.Tensor2D, k: number): tf.Tensor2D {\n  return tf.tidy(\n    () => tf.sub(tf.mul(tf.cast(tf.equal(\n
segmentation, tf.scalar(k), 'int32'), tf.add(bodyParts, 1)), 1));\n  )\n}\n\nfunction isWebGlBackend() {\n  return
getBackend() === 'webgl';\n}\n\nexport async function decodePersonInstanceMasks(\n  segmentation:
tf.Tensor2D, longOffsets: tf.Tensor3D, poses:
Pose[],\n  height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number], padding:
Padding, minPoseScore = 0.2,\n  refineSteps = 8, minKeypointScore = 0.3,\n  maxNumPeople = 10): Promise<PersonSegmentation[]> {\n  // Filter out poses with smaller score.\n  const posesAboveScore =
poses.filter(pose => pose.score >= minPoseScore);\n  \n  let personSegmentationsData: Uint8Array[];\n  \n  if
(isWebGlBackend()) {\n    const personSegmentations = tf.tidy(() => {\n      const masksTensorInfo =
decodeMultipleMasksWebGl(\n        segmentation, longOffsets, posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding, refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n        masksTensorInfo.dtype) as tf.Tensor2D;\n      \n      return posesAboveScore.map(\n        (_, k) =>
toPersonKSegmentation(masksTensor, k);\n      );\n    });\n    \n    personSegmentationsData =\n      (await Promise.all(personSegmentations.map(mask => mask.data())) as\n      Uint8Array[]);\n    \n    personSegmentations.forEach(x => x.dispose());\n  } else {\n    const segmentationsData =
await segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data() as Float32Array;\n    \n    personSegmentationsData = decodeMultipleMasksCPU(\n      segmentationsData, longOffsetsData,
posesAboveScore, height, width,\n      stride, [inHeight, inWidth], padding, refineSteps);\n    \n    return
personSegmentationsData.map(\n      (data, i) => ({data, pose: posesAboveScore[i], width, height});\n    );\n  }\n}\n\nexport
async function decodePersonInstancePartMasks(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n  partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n  stride: number, [inHeight,
inWidth]: [number, number], padding: Padding,\n  minPoseScore = 0.2, refineSteps = 8, minKeypointScore =
0.3,\n  maxNumPeople = 10): Promise<PartSegmentation[]> {\n  const posesAboveScore = poses.filter(pose =>
pose.score >= minPoseScore);\n  \n  let partSegmentationsByPersonData: Int32Array[];\n  \n  if (isWebGlBackend())
{\n    const partSegmentations = tf.tidy(() => {\n      const masksTensorInfo = decodeMultipleMasksWebGl(\n
segmentation, longOffsets, posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding,
refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n        masksTensorInfo.dtype) as tf.Tensor2D;\n      \n      return posesAboveScore.map(\n        (_, k) =>\n
toPersonKPartSegmentation(masksTensor, partSegmentation, k);\n      );\n    });\n    \n    partSegmentationsByPersonData =\n      (await Promise.all(partSegmentations.map(x => x.data())) as\n      Int32Array[]);\n    \n    partSegmentations.forEach(x => x.dispose());\n  } else
{\n    const segmentationsData = await segmentation.data() as Uint8Array;\n    const longOffsetsData = await
longOffsets.data() as Float32Array;\n    const partSegmentaionData = await partSegmentation.data() as
Uint8Array;\n    \n    partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n      segmentationsData,
longOffsetsData, partSegmentaionData,\n      posesAboveScore, height, width, stride, [inHeight, inWidth],
padding,\n      refineSteps);\n    \n    return partSegmentationsByPersonData.map(\n      (data, k) => ({pose:
posesAboveScore[k], data, height, width});\n    );\n  }\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights
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```

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```
=====
*\n\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n//
https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n\nfunction half(k: number) {\n return
Math.floor(k / 2);\n}\n\nexport class MaxHeap<T> {\n private priorityQueue: T[];\n private numberOfElements:
number;\n private getElementValue: (element: T) => number;\n\n constructor(maxSize: number, getElementValue:
(element: T) => number) {\n this.priorityQueue = new Array(maxSize);\n this.numberOfElements = -1;\n
this.getElementValue = getElementValue;\n }\n\n public enqueue(x: T): void {\n
this.priorityQueue[++this.numberOfElements] = x;\n this.swim(this.numberOfElements);\n
}\n\n public dequeue(): T {\n const max = this.priorityQueue[0];\n this.exchange(0, this.numberOfElements--
);\n this.sink(0);\n this.priorityQueue[this.numberOfElements + 1] = null;\n return max;\n }\n\n public
empty(): boolean {\n return this.numberOfElements === -1;\n }\n\n public size(): number {\n return
this.numberOfElements + 1;\n }\n\n public all(): T[] {\n return this.priorityQueue.slice(0, this.numberOfElements
+ 1);\n }\n\n public max(): T {\n return this.priorityQueue[0];\n }\n\n private swim(k: number): void {\n while
(k > 0 && this.less(half(k), k)) {\n this.exchange(k, half(k));\n k = half(k);\n }\n }\n\n private sink(k:
number): void {\n while (2 * k <= this.numberOfElements) {\n let j = 2 * k;\n if (j < this.numberOfElements
&& this.less(j, j + 1)) {\n j++;\n }\n if (!this.less(k, j)) {\n break;\n }\n this.exchange(k, j);\n
k = j;\n }\n }\n\n private getValueAt(i:
number): number {\n return this.getElementValue(this.priorityQueue[i]);\n }\n\n private less(i: number, j:
number): boolean {\n return this.getValueAt(i) < this.getValueAt(j);\n }\n\n private exchange(i: number, j:
number): void {\n const t = this.priorityQueue[i];\n this.priorityQueue[i] = this.priorityQueue[j];\n
this.priorityQueue[j] = t;\n }\n\n"}\n\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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```

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```
=====
*\n\nimport {PartWithScore, TensorBuffer3D} from './types';\n\nimport {MaxHeap} from
'./max_heap';\n\nfunction scoreIsMaximumInLocalWindow(\n keypointId: number, score: number, heatmapY:
number, heatmapX: number,\n localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n const
[height, width] = scores.shape;\n\n let localMaximum = true;\n const yStart = Math.max(heatmapY -
localMaximumRadius, 0);\n const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n for (let
yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n const xStart = Math.max(heatmapX - localMaximumRadius,
0);\n const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n for (let xCurrent = xStart;
xCurrent < xEnd; ++xCurrent) {\n if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n localMaximum
= false;\n break;\n }\n }\n if (!localMaximum)\n {\n break;\n }\n }\n\n return localMaximum;\n }\n\n"}\n\n * Builds a priority queue with part candidate
positions for a specific image in\n * the batch. For this we find all local maxima in the score maps with score\n *
values above a threshold. We create a single priority queue across all parts.\n\n */\n\nexport function
buildPartWithScoreQueue(\n scoreThreshold: number, localMaximumRadius: number,\n scores:
TensorBuffer3D): MaxHeap<PartWithScore> {\n const [height, width, numKeypoints] = scores.shape;\n\n const
```

```

queue = new MaxHeap<PartWithScore>(\n    height * width * numKeypoints, ({score}) => score);\n\n for (let
heatmapY = 0; heatmapY < height; ++heatmapY) {\n    for (let heatmapX = 0; heatmapX < width; ++heatmapX) {\n
    for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {\n        const score = scores.get(heatmapY,
heatmapX, keypointId);\n        // Only consider parts with score greater or equal to threshold as\n        // root
candidates.\n
        if (score < scoreThreshold) {\n            continue;\n        }\n        // Only consider keypoints whose score is
maximum in a local window.\n        if (scoreIsMaximumInLocalWindow(\n            keypointId, score, heatmapY,
heatmapX, localMaximumRadius,\n            scores)) {\n            queue.enqueue({score, part: {heatmapY, heatmapX,
id: keypointId}});\n        }\n    }\n}\n}\n}\n\n return queue;\n}\n"/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';\nimport {Keypoint,
PartWithScore, TensorBuffer3D, Vector2D} from './types';\nimport {clamp, getOffsetPoint} from './util';\nimport
{addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n    ([parentJoinName, childJoinName]): NumberTuple =>\n
    ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\n
parentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\n
parentChildrenTuples.map(([\n        parentJointId,\n        ] =>
parentJointId);\n\nfunction getDisplacement(\n    edgeId: number, point: Vector2D, displacements:
TensorBuffer3D): Vector2D {\n    const numEdges =
displacements.shape[2] / 2;\n    return {\n        y: displacements.get(point.y, point.x, edgeId),\n        x:
displacements.get(point.y, point.x, numEdges + edgeId)\n    };\n}\n\nfunction getStridedIndexNearPoint(\n    point:
Vector2D, outputStride: number, height: number,\n    width: number): Vector2D {\n    return {\n        y:
clamp(Math.round(point.y / outputStride), 0, height - 1),\n        x: clamp(Math.round(point.x / outputStride), 0, width -
1)\n    };\n}\n\n/**\n * We get a new keypoint along the `edgeId` for the pose instance, assuming\n * that the position
of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target
part (stored in\n * the `i`-t channel of the displacement tensor). The displaced keypoint\n * vector is refined using
the offset vector by `offsetRefineStep` times.\n */\nfunction traverseToTargetKeypoint(\n    edgeId: number,
sourceKeypoint: Keypoint, targetKeypointId: number,\n    scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D,
outputStride: number,\n    displacements: TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n    const [height,
width] = scoresBuffer.shape;\n\n    // Nearest neighbor interpolation for the source->target displacements.\n    const
sourceKeypointIndices = getStridedIndexNearPoint(\n        sourceKeypoint.position, outputStride, height, width);\n\n    const displacement =\n        getDisplacement(edgeId, sourceKeypointIndices, displacements);\n\n    const
displacedPoint = addVectors(sourceKeypoint.position, displacement);\n    let targetKeypoint = displacedPoint;\n    for
(let i = 0; i < offsetRefineStep; i++) {\n        const targetKeypointIndices =\n
getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n        const offsetPoint = getOffsetPoint(\n
            targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId,\n            offsets);\n\n        targetKeypoint =
addVectors(\n            {\n                x: targetKeypointIndices.x * outputStride,\n                y: targetKeypointIndices.y
* outputStride\n            },\n            {x: offsetPoint.x, y: offsetPoint.y});\n    }\n\n    const targetKeypointIndices =\n
getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n    const score = scoresBuffer.get(\n
        targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId);\n\n    return {position: targetKeypoint, part:
PART_NAMES[targetKeypointId], score};\n}\n\n/**\n * Follows the displacement fields to decode the full pose of
the object\n * instance given the position of a part that acts as root.\n * \n * @return An array of decoded keypoints

```

```

and their scores for a single pose\n *^\nexport function decodePose(\n  root: PartWithScore, scores:
TensorBuffer3D, offsets: TensorBuffer3D,\n  outputStride: number, displacementsFwd: TensorBuffer3D,\n  displacementsBwd: TensorBuffer3D): Keypoint[] {\n  const numParts = scores.shape[2];\n  const numEdges =
parentToChildEdges.length;\n\n  const instanceKeypoints: Keypoint[] = new Array(numParts);\n  // Start a new
detection instance at the position of the root.\n  const {part: rootPart, score: rootScore} = root;\n  const rootPoint =
getImageCoords(rootPart, outputStride, offsets);\n\n  instanceKeypoints[rootPart.id] = {\n  score: rootScore,\n
part: PART_NAMES[rootPart.id],\n  position: rootPoint\n  };\n\n  // Decode the part positions upwards in the tree,
following the backward\n  // displacements.\n  for (let edge = numEdges - 1; edge >= 0; --edge) {\n  const
sourceKeypointId = parentToChildEdges[edge];\n  const targetKeypointId = childToParentEdges[edge];\n  if
(instanceKeypoints[sourceKeypointId] &&\n    !instanceKeypoints[targetKeypointId]) {\n
instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n    edge,
instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n    offsets, outputStride, displacementsBwd);\n
  }\n  }\n\n  // Decode the part positions downwards in the tree, following the forward\n  // displacements.\n  for (let
edge = 0;
edge < numEdges; ++edge) {\n  const sourceKeypointId = childToParentEdges[edge];\n  const targetKeypointId
= parentToChildEdges[edge];\n  if (instanceKeypoints[sourceKeypointId] &&\n    !instanceKeypoints[targetKeypointId]) {\n
instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n    edge, instanceKeypoints[sourceKeypointId],
targetKeypointId, scores,\n    offsets, outputStride,
displacementsFwd);\n  }\n  }\n\n  return instanceKeypoints;\n}\n\n"/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====\n
*/\n\nimport {Keypoint, Pose, TensorBuffer3D} from './types';\n\nimport {buildPartWithScoreQueue} from
'./build_part_with_score_queue';\nimport {decodePose} from './decode_pose';\nimport {getImageCoords,
squaredDistance} from './util';\n\nfunction withinNmsRadiusOfCorrespondingPoint(\n  poses: Pose[],
squaredNmsRadius: number, {x, y}: {x: number, y: number},\n  keypointId: number): boolean {\n  return
poses.some(({keypoints}) => {\n  const correspondingKeypoint = keypoints[keypointId].position;\n  return
squaredDistance(\n    y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n
squaredNmsRadius;\n  });\n}\n\n/* Score the newly proposed object instance without taking into account\n * the
scores of the parts that overlap with any previously detected\n
* instance.\n */\n\nfunction getInstanceScore(\n  existingPoses: Pose[], squaredNmsRadius: number,\n
instanceKeypoints: Keypoint[]): number {\n  let notOverlappedKeypointScores = instanceKeypoints.reduce(\n
(result, {position, score}, keypointId): number => {\n  if (!withinNmsRadiusOfCorrespondingPoint(\n
existingPoses, squaredNmsRadius, position, keypointId)) {\n    result += score;\n  }\n  return result;\n
}, 0.0);\n\n  return notOverlappedKeypointScores / instanceKeypoints.length;\n}\n\n// A point (y, x) is considered
as root part candidate if its score is a\n// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n//
kLocalMaximumRadius.\n\nconst kLocalMaximumRadius = 1;\n\n/**\n * Detects multiple poses and finds their parts
from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in
decreasing root score order. It works as follows: We first\n * create a priority
queue with local part score maxima above\n * `scoreThreshold`, considering all parts at the same time. Then we\n *
iteratively pull the top element of the queue (in decreasing score order)\n * and treat it as a root candidate for a new
object instance. To avoid\n * duplicate detections, we reject the root candidate if it is within a disk\n * of
`nmsRadius` pixels from the corresponding part of a previously detected\n * instance, which is a form of part-based

```

```

non-maximum suppression (NMS). If the root candidate passes the NMS check, we start a new object instance
detection, treating the corresponding part as root and finding the positions of the remaining parts by following
the displacement vectors along the tree-structured part graph. We assign to the newly detected instance a
score equal to the sum of scores of its parts which have not been claimed by a previous instance (i.e., those at
least nmsRadius pixels away from the corresponding part of all previously
detected instances), divided by the total number of parts numParts. The value of heatmapScores 3-D tensor
with shape [height, width, numParts] is the score of placing the k-th
object part at position (y, x). The value of offsets 3-D tensor with shape [height, width, numParts * 2]
The value of [offsets[y, x, k], offsets[y, x, k + numParts]] is the short range offset vector of the k-th
object part at heatmap position (y, x). The displacementsFwd 3-D tensor of shape [height, width, 2 *
num_edges], where num_edges = num_parts - 1 is the number of edges (parent-child pairs) in the tree. It
contains the forward displacements between consecutive part from the root towards the leaves. The
displacementsBwd 3-D tensor of shape [height, width, 2 * num_edges], where num_edges = num_parts - 1 is
the number of edges (parent-child pairs) in the tree. It contains
the backward displacements between consecutive part from the root towards the leaves.
outputStride The output stride that was used when feed-forwarding through the PoseNet model. Must be 32, 16,
or 8.
maxPoseDetections Maximum number of returned instance detections per image.
scoreThreshold Only return instance detections that have root part score greater or equal to this value.
Defaults to 0.5.
nmsRadius Non-maximum suppression part distance. It needs to be strictly
positive. Two parts suppress each other if they are less than nmsRadius pixels away. Defaults to 20.
return An array of poses and their scores, each containing keypoints and the corresponding keypoint scores.
export function decodeMultiplePoses(scoresBuffer: TensorBuffer3D, offsetsBuffer: TensorBuffer3D,
displacementsFwdBuffer: TensorBuffer3D, displacementsBwdBuffer: TensorBuffer3D, outputStride: number,
maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {
  const poses: Pose[] = [];
  const queue = buildPartWithScoreQueue(scoreThreshold, kLocalMaximumRadius, scoresBuffer);
  const squaredNmsRadius = nmsRadius * nmsRadius;
  // Generate at most maxDetections object instances per image
  in // decreasing root part score order.
  while (poses.length < maxPoseDetections && !queue.empty()) {
    // The top element in the queue is the next root candidate.
    const root = queue.dequeue();
    // Part-based non-
    maximum suppression: We reject a root candidate if it
    // is within a disk of nmsRadius pixels from the
    corresponding part of
    // a previously detected instance.
    const rootImageCoords =
    getImageCoords(root.part, outputStride, offsetsBuffer);
    if (withinNmsRadiusOfCorrespondingPoint(
    poses, squaredNmsRadius, rootImageCoords, root.part.id)) {
      continue;
    }
    // Start a new detection
    instance at the position of the root.
    const keypoints = decodePose(root, scoresBuffer, offsetsBuffer,
    outputStride, displacementsFwdBuffer, displacementsBwdBuffer);
    const score =
    getInstanceScore(poses, squaredNmsRadius, keypoints);
    poses.push({keypoints, score});
  }
  return
  poses;
}
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 * limitations under the License.
 */
import * as tf from '@tensorflow/tfjs-core';
import { BaseModel } from './base_model';
const
imageNetMean = [-123.15, -115.90, -103.06];
export class ResNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    return tf.add(input, imageNetMean);
  }
  nameOutputResults(results: tf.Tensor3D[]) {
    const [displacementBwd, displacementFwd,
heatmap, longOffsets, offsets, partHeatmaps, segmentation, partOffsets, ] = results;
    return [offsets, segmentation, partHeatmaps, longOffsets, heatmap,

```

```

displacementFwd,\n displacementBwd,\n partOffsets\n };\n }\n}\n","/*\n * @license\n * Copyright 2019
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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=====
*\n\nconst RESNET50_BASE_URL =\n 'https://storage.googleapis.com/tfjs-
models/savedmodel/bodypix/resnet50/';\nconst MOBILENET_BASE_URL =\n
'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet/';\n\n// The BodyPix 2.0 ResNet50
models use the latest TensorFlow.js 1.0 model\n// format.\nexport function resNet50SavedModel(stride: number,
quantBytes: number): string {\n const graphJson = `model-stride${stride}.json`;\n // quantBytes=4 corresponding
to the non-quantized
full-precision SavedModel.\n if (quantBytes === 4) {\n return RESNET50_BASE_URL + `float^` + graphJson;\n
} else {\n return RESNET50_BASE_URL + `quant${quantBytes}` + graphJson;\n }\n}\n\n// The BodyPix 2.0
MobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function mobileNetSavedModel(\n
stride: number, multiplier: number, quantBytes: number): string {\n const toStr: {[key: number]: string} = {1.0:
'100', 0.75: '075', 0.50: '050'};\n const graphJson = `model-stride${stride}.json`;\n // quantBytes=4 corresponding
to the non-quantized full-precision SavedModel.\n if (quantBytes === 4) {\n return MOBILENET_BASE_URL +
`float/${toStr[multiplier]}` + graphJson;\n } else {\n return MOBILENET_BASE_URL +
`quant${quantBytes}/${toStr[multiplier]}` +\n graphJson;\n }\n}\n}\n","/*\n * @license\n * Copyright 2020
Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n *
=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport {BodyPixInput, BodyPixOutputStride, Padding} from
'./types';\nimport {Pose, TensorBuffer3D} from './types';\nimport {BodyPixInternalResolution} from
'./types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\n
HTMLCanvasElement|\n OffscreenCanvas): [number, number] {\n if ('offsetHeight'
in input && input.offsetHeight !== 0\n && 'offsetWidth' in input && input.offsetWidth !== 0) {\n return
[input.offsetHeight, input.offsetWidth];\n } else if (input.height !== null && input.width !== null) {\n return
[input.height, input.width];\n } else {\n throw new Error(\n `HTMLImageElement must have height and
width attributes set.`);\n }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,
number] {\n if (input.hasAttribute('height') && input.hasAttribute('width')) {\n // Prioritizes user specified height
and width.\n // We can't test the .height and .width properties directly,\n // because they evaluate to 0 if unset.\n
return [input.height, input.width];\n } else {\n return [input.videoHeight, input.videoWidth];\n }\n}\n\nexport
function getInputSize(input: BodyPixInput): [number, number] {\n if (((typeof (HTMLCanvasElement) !==
'undefined' &&\n input instanceof HTMLCanvasElement) ||\n (typeof (OffscreenCanvas)
!== 'undefined' &&\n input instanceof OffscreenCanvas) ||\n (typeof (HTMLImageElement) !==
'undefined' &&\n input instanceof HTMLImageElement)) {\n return getSizeFromImageLikeElement(input);\n
} else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {\n return [input.height,
input.width];\n } else if (\n typeof (HTMLVideoElement) !== 'undefined' &&\n input instanceof
HTMLVideoElement) {\n return getSizeFromVideoElement(input);\n } else if (input instanceof tf.Tensor) {\n

```



```

return [input.shape[0], input.shape[1]];
} else {
  throw new Error(`error: Unknown input type: ${input}`);
}
}

function isValidInputResolution(
  resolution: number, outputStride: number): boolean {
  return (resolution - 1) % outputStride === 0;
}

export function toValidInputResolution(
  inputResolution: number, outputStride: BodyPixOutputStride): number {
  if (isValidInputResolution(inputResolution, outputStride)) {
    return inputResolution;
  }
  return Math.floor(inputResolution / outputStride) * outputStride + 1;
}

const INTERNAL_RESOLUTION_STRING_OPTIONS = {
  low: 'low',
  medium: 'medium',
  high: 'high',
  full: 'full'
};

const INTERNAL_RESOLUTION_PERCENTAGES = {
  [INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,
  [INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,
  [INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,
  [INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0
};

const MIN_INTERNAL_RESOLUTION = 0.1;
const MAX_INTERNAL_RESOLUTION = 2.0;

function toInternalResolutionPercentage(
  internalResolution: BodyPixInternalResolution): number {
  if (typeof internalResolution === 'string') {
    const result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];
    tf.util.assert(
      typeof result === 'number',
      () => `string value of inputResolution must be one of ${
        Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)
          .join(',')
      } but was ${internalResolution}`);
    return result;
  } else {
    tf.util.assert(
      typeof internalResolution === 'number' &&
      internalResolution <= MAX_INTERNAL_RESOLUTION &&
      internalResolution >= MIN_INTERNAL_RESOLUTION,
      () => `inputResolution must be a string or number between ${
        MIN_INTERNAL_RESOLUTION
      } and ${MAX_INTERNAL_RESOLUTION}, but ` +
      `was ${internalResolution}`);
    return internalResolution;
  }
}

export function toInputResolutionHeightAndWidth(
  internalResolution: BodyPixInternalResolution,
  outputStride: BodyPixOutputStride,
  [inputHeight, inputWidth]: [number, number]): [number, number] {
  const internalResolutionPercentage =
    toInternalResolutionPercentage(internalResolution);
  return [
    toValidInputResolution(
      inputHeight * internalResolutionPercentage, outputStride),
    toValidInputResolution(
      inputWidth * internalResolutionPercentage,
      outputStride)
  ];
}

export function toInputTensor(input: BodyPixInput) {
  // TODO: tf.browser.fromPixels types to support OffscreenCanvas
  // @ts-ignore
  return input instanceof tf.Tensor ? input :
    tf.browser.fromPixels(input);
}

export function resizeAndPadTo(
  imageTensor: tf.Tensor3D, [targetH, targetW]: [number, number],
  flipHorizontal = false): {
  resizedAndPadded: tf.Tensor3D,
  paddedBy: [[number, number], [number, number]]
} {
  const [height, width] = imageTensor.shape;
  const targetAspect = targetW / targetH;
  const aspect = width / height;
  let resizeW: number;
  let resizeH: number;
  let padL: number;
  let padR: number;
  let padT: number;
  let padB: number;
  if (aspect > targetAspect) {
    // resize to have the larger dimension match the shape.
    resizeW = targetW;
    resizeH = Math.ceil(resizeW / aspect);
    const padHeight = targetH - resizeH;
    padL = 0;
    padR = 0;
    padT = Math.floor(padHeight / 2);
    padB = targetH - (resizeH + padT);
  } else {
    resizeH = targetH;
    resizeW = Math.ceil(targetH * aspect);
    const padWidth = targetW - resizeW;
    padL = Math.floor(padWidth / 2);
    padR = targetW - (resizeW + padL);
    padT = 0;
    padB = 0;
  }
  const resizedAndPadded = tf.tidy(() => {
    // resize to have largest dimension match image
    let resized: tf.Tensor3D;
    if (flipHorizontal) {
      resized = tf.image.resizeBilinear(
        tf.reverse(imageTensor, 1), [resizeH, resizeW]);
    } else {
      resized = tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);
    }
    const padded = tf.pad3d(resized, [[padT, padB], [padL, padR], [0, 0]]);
    return padded;
  });
  return {resizedAndPadded, paddedBy: [[padT, padB], [padL, padR]]};
}

export function scaleAndCropToInputTensorShape(
  tensor: tf.Tensor3D,
  [inputTensorHeight, inputTensorWidth]: [number, number],
  [resizedAndPaddedHeight, resizedAndPaddedWidth]: [number, number],
  [[padT, padB], [padL, padR]]: [[number, number], [number, number]],
  applySigmoidActivation = false): tf.Tensor3D {
  return tf.tidy(() => {
    let inResizedAndPadded: tf.Tensor3D = tf.image.resizeBilinear(
      tensor, [resizedAndPaddedHeight, resizedAndPaddedWidth], true);
    if (applySigmoidActivation) {
      inResizedAndPadded = tf.sigmoid(inResizedAndPadded);
    }
    return

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removePaddingAndResizeBack(\n      inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n      [[padT, padB], [padL, padR]]);\n  });\n}\n\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded:\n  tf.Tensor3D,\n  [originalHeight, originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number,\n  number], [number, number]]):\n  tf.Tensor3D {\n    return tf.tidy(() => {\n      const batchSize: number =\n        tf.expandDims(resizedAndPadded).shape[0];\n      return tf.squeeze(tf.image\n        .cropAndResize(\n          batchSize, [\n            padT / (originalHeight + padT + padB - 1.0),\n            padL / (originalWidth +\n            padL + padR - 1.0),\n            (padT + originalHeight - 1.0) / (\n              originalHeight + padT + padB - 1.0),\n            (padL + originalWidth - 1.0) / (\n              originalWidth + padL + padR - 1.0)\n            ]), [0], [originalHeight,\n            originalWidth]), [0]);\n    });\n}\n\n\nexport function resize2d(\n  tensor: tf.Tensor2D, resolution: [number, number],\n  nearestNeighbor?: boolean): tf.Tensor2D {\n    return tf.tidy(() => {\n      const batchSize: number =\n        tf.expandDims(tensor, 2).shape[0];\n      return tf.squeeze(\n        tf.image.resizeBilinear(batchSize, resolution,\n        nearestNeighbor));\n    });\n}\n\n\nexport function padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]:\n  [number, number]):\n  {resized: tf.Tensor3D, padding: Padding} {\n    const [height, width] = getInputSize(input);\n    const targetAspect = targetW / targetH;\n    const aspect\n      = width / height;\n    let [padT, padB, padL, padR] = [0, 0, 0, 0];\n    if (aspect < targetAspect) {\n      // pads the width\n      padT = 0;\n      padB = 0;\n      padL = Math.round(0.5 * (targetAspect * height - width));\n      padR = Math.round(0.5\n        * (targetAspect * height - width));\n    } else {\n      // pads the height\n      padT = Math.round(0.5 * ((1.0 /\n        targetAspect) * width - height));\n      padB = Math.round(0.5 * ((1.0 /\n        targetAspect) * width - height));\n      padL =\n        0;\n      padR = 0;\n    }\n    const resized: tf.Tensor3D = tf.tidy(() => {\n      let imageTensor = toInputTensor(input);\n      imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);\n      return\n        tf.image.resizeBilinear(imageTensor, [targetH, targetW]);\n    });\n    return {resized, padding: {top: padT, left: padL,\n      right: padR, bottom: padB}};\n  }\n}\n\n\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\n  Promise<TensorBuffer3D[]> {\n    return Promise.all(tensors.map(tensor => tensor.buffer()));\n  }\n}\n\n\nexport\n  function scalePose(\n    pose: Pose, scaleY: number, scaleX: number, offsetY = 0,\n    offsetX = 0): Pose {\n    return\n      {\n        score: pose.score,\n        keypoints: pose.keypoints.map(({score, part, position}) => ({\n          score,\n          part,\n          position: {\n            x: position.x *\n            scaleX + offsetX,\n            y: position.y * scaleY + offsetY\n          }\n        })))\n      }\n  }\n}\n\n\nexport function scalePoses(\n  poses: Pose[], scaleY: number, scaleX: number, offsetY = 0,\n  offsetX = 0) {\n    if (scaleX === 1 && scaleY === 1 && offsetY === 0 && offsetX === 0)\n      return poses;\n    return poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));\n  }\n}\n\n\nexport function\n  flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {\n    return {\n      score: pose.score,\n      keypoints: pose.keypoints.map(\n        ({score, part, position}) => ({\n          score,\n          part,\n          position: {\n            x: imageWidth - 1 - position.x,\n            y: position.y\n          }\n        })\n      )\n    }\n  }\n}\n\n\nexport function flipPosesHorizontal(poses: Pose[],\n  imageWidth: number) {\n    if (imageWidth <= 0)\n      return poses;\n    return poses.map(pose =>\n      flipPoseHorizontal(pose, imageWidth));\n  }\n}\n\n\nexport function\n  scaleAndFlipPoses(\n    poses: Pose[], [height, width]: [number, number],\n    [inputResolutionHeight, inputResolutionWidth]: [number, number],\n    padding:\n    Padding, flipHorizontal: boolean): Pose[] {\n    const scaleY =\n      (height + padding.top + padding.bottom) /\n      (inputResolutionHeight);\n    const scaleX =\n      (width + padding.left + padding.right) /\n      (inputResolutionWidth);\n    const scaledPoses =\n      scalePoses(poses, scaleY, scaleX, -padding.top, -\n      padding.left);\n    if (flipHorizontal)\n      return flipPosesHorizontal(scaledPoses, width);\n    else\n      return\n        scaledPoses;\n  }\n}\n\n\n", "\n**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport
{BaseModel} from './base_model';\nimport {decodeOnlyPartSegmentation, decodePartSegmentation,
toMaskTensor} from './decode_part_map';\nimport
{MobileNet} from './mobilenet';\nimport {decodePersonInstanceMasks, decodePersonInstancePartMasks} from
'./multi_person/decode_instance_masks';\nimport {decodeMultiplePoses} from
'./multi_person/decode_multiple_poses';\nimport {ResNet} from './resnet';\nimport {mobileNetSavedModel,
resNet50SavedModel} from './saved_models';\nimport {BodyPixArchitecture, BodyPixInput,
BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding} from
'./types';\nimport {PartSegmentation, PersonSegmentation, SemanticPartSegmentation,
SemanticPersonSegmentation} from './types';\nimport {getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D}
from './util';\n\nconst APPLY_SIGMOID_ACTIVATION = true;\nconst FLIP_POSES_AFTER_SCALING =
false;\n\n**\n * BodyPix model loading is configurable using the following config dictionary.\n *\n *
`architecture`: BodyPixArchitecture. It determines which BodyPix
architecture\n * to load. The supported architectures are: MobileNetV1 and ResNet50.\n * `outputStride`:
Specifies the output stride of the BodyPix model.\n * The smaller the value, the larger the output resolution, and
more accurate\n * the model at the cost of speed. Set this to a larger value to increase speed\n * at the cost of
accuracy. Stride 32 is supported for ResNet and\n * stride 8,16,32 are supported for various MobileNetV1 models.\n
*\n * `multiplier`: An optional number with values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by MobileNet
architecture. It is the float\n * multiplier for the depth (number of channels) for all convolution ops.\n * The larger
the value, the larger the size of the layers, and more accurate\n * the model at the cost of speed. Set this to a smaller
value to increase speed\n * at the cost of accuracy.\n *\n * `modelUrl`: An optional string that specifies custom url
of the model. This\n * is useful for area/countries that don't have access
to the model hosted on\n * GCP.\n *\n * `quantBytes`: An optional number with values: 1, 2, or 4. This
parameter\n * affects weight quantization in the models. The available options are\n * 1 byte, 2 bytes, and 4 bytes.
The higher the value, the larger the model size\n * and thus the longer the loading time, the lower the value, the
shorter the\n * loading time but lower the accuracy.\n */\nexport interface ModelConfig {\n architecture:
BodyPixArchitecture;\n outputStride: BodyPixOutputStride;\n multiplier?: BodyPixMultiplier;\n modelUrl?:
string;\n quantBytes?: BodyPixQuantBytes;\n}\n\n// The default configuration for loading MobileNetV1 based
BodyPix.\n\n// (And for references, the default configuration for loading ResNet\n// based PoseNet is also
included).\n\n// ``\n// const RESNET_CONFIG = {\n// architecture: 'ResNet50',\n// outputStride: 32,\n//
quantBytes: 4,\n// } as ModelConfig;\n// ``\n\nconst MOBILENET_V1_CONFIG = {\n architecture:
'MobileNetV1',\n
outputStride: 16,\n quantBytes: 4,\n multiplier: 0.75,\n} as ModelConfig;\n\nconst VALID_ARCHITECTURE:
BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\nconst VALID_STRIDE: {[id: string]:
BodyPixOutputStride[]} = {\n 'MobileNetV1': [8, 16, 32],\n 'ResNet50': [32, 16]\n};\n\nconst
VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n 'MobileNetV1': [0.50, 0.75, 1.0],\n 'ResNet50':
[1.0]\n};\n\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\n\nfunction
validateModelConfig(config: ModelConfig): ModelConfig {\n config = config || MOBILENET_V1_CONFIG;\n\n
if (config.architecture == null) {\n config.architecture = 'MobileNetV1';\n }\n\n if
(VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n throw new Error(\n `Invalid architecture
${config.architecture}.` +\n `Should be one of ${VALID_ARCHITECTURE}`);\n }\n\n if (config.outputStride
== null) {\n config.outputStride = 16;\n }\n\n if
(VALID_STRIDE[config.architecture].indexOf(config.outputStride)
< 0) {\n throw new Error(\n `Invalid outputStride ${config.outputStride}.` +\n `Should be one of
${VALID_STRIDE[config.architecture]} ` +\n `for architecture ${config.architecture}.`);\n }\n\n if
(config.multiplier == null) {\n config.multiplier = 1.0;\n }\n\n if
(VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n throw new Error(\n `Invalid

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multiplier ${config.multiplier}. ` +\n    `Should be one of ${VALID_MULTIPLIER[config.architecture]} ` +\n
`for architecture ${config.architecture}.`);\n } \n\n if (config.quantBytes == null) {\n    config.quantBytes = 4;\n
}\n\n if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n    throw new Error(\n    `Invalid
quantBytes ${config.quantBytes}. ` +\n    `Should be one of ${VALID_QUANT_BYTES} ` +\n    `for
architecture ${config.architecture}.`);\n } \n\n return config;\n}\n\n**\n * BodyPix inference is configurable using
the following config dictionary.\n
*\n * `flipHorizontal`: If the left-right keypoint of poses/part segmentation\n * should be flipped/mirrored
horizontally. This should be set to true for\n * videos where the video is by default flipped horizontally (i.e. a
webcam),\n * and you want the person & body part segmentation to be returned in the proper\n * orientation.\n *\n *
`internalResolution`: Defaults to 'medium'. The internal resolution\n * percentage that the input is resized to before
inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction
times. Available values are 'low', 'medium', 'high', 'full', or a\n * percentage value between 0 and 1. The values 'low',
'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n *\n * `segmentationThreshold`: The
minimum that segmentation values must\n * have to be considered part of the person. Affects the generation of the\n
* segmentation mask. More specifically, it is the threshold
used to binarize\n * the intermediate person segmentation probability. The probability of each\n * pixel belongs to a
person is in range [0, 1]. If the probability is greater\n * than the `segmentationThreshold`, it will be set to 1
otherwise 0.\n *\n */\nexport interface InferenceConfig {\n    flipHorizontal?: boolean;\n    internalResolution?:
BodyPixInternalResolution;\n    segmentationThreshold?: number;\n}\n\n**\n * Person Inference Config\n *\n *
`maxDetections`: Defaults to 10. Maximum number of person pose detections per\n * image.\n *\n *
`scoreThreshold`: Defaults to 0.4. Only return person pose that have root\n * part score greater or equal to this
value.\n *\n * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n * It needs to be
strictly positive. Two pose keypoints suppress each other if\n * they are less than `nmsRadius` pixels away.\n
*\n */\nexport interface PersonInferenceConfig extends InferenceConfig {\n    maxDetections?: number;\n    scoreThreshold?:
number;\n    nmsRadius?: number;\n}\n\n**\n * Multiple Person Instance Inference Config\n *\n * `maxDetections`:
Defaults to 10. Maximum number of returned instance\n * segmentation and pose detections per image.\n *\n *
`scoreThreshold`: Defaults to 0.4. Only returns and uses person\n * poses for instance segmentation assignment
when the pose has root part score\n * greater or equal to this value.\n *\n * `nmsRadius`: Defaults to 20. Non-
maximum suppression part distance in pixels.\n * It needs to be strictly positive. Two parts suppress each other if
they are\n * less than `nmsRadius` pixels away.\n *\n * `minKeypointScore`: Default to 0.3. Keypoints above the
score are used\n * for matching and assigning segmentation mask to each person.\n *\n * `refineSteps`: Default to
10. The number of refinement steps used when\n * assigning the instance segmentation. It needs to be strictly
positive. The\n * larger the higher the accuracy and slower the inference.\n *\n */\nexport interface
MultiPersonInstanceInferenceConfig
extends InferenceConfig {\n    maxDetections?: number;\n    scoreThreshold?: number;\n    nmsRadius?: number;\n    minKeypointScore?: number;\n    refineSteps?: number;\n}\n\nexport const PERSON_INFERENCE_CONFIG:
PersonInferenceConfig = {\n    flipHorizontal: false,\n    internalResolution: 'medium',\n    segmentationThreshold:
0.7,\n    maxDetections: 10,\n    scoreThreshold: 0.4,\n    nmsRadius: 20,\n};\n\nexport const
MULTI_PERSON_INSTANCE_INFERENCE_CONFIG:\n MultiPersonInstanceInferenceConfig = {\n    flipHorizontal: false,\n    internalResolution: 'medium',\n    segmentationThreshold: 0.7,\n    maxDetections:
10,\n    scoreThreshold: 0.4,\n    nmsRadius: 20,\n    minKeypointScore: 0.3,\n    refineSteps: 10\n
};\n\nfunction validatePersonInferenceConfig(config: PersonInferenceConfig) {\n    const {segmentationThreshold,
maxDetections, scoreThreshold, nmsRadius} =\n    config;\n\n    if (segmentationThreshold < 0.0 ||
segmentationThreshold > 1.0) {\n        throw new Error(\n        `segmentationThreshold ${segmentationThreshold}. ` +\n        `Should be in range [0.0,
1.0]`);\n    }\n\n    if (maxDetections <= 0) {\n        throw new Error(\n        `Invalid maxDetections ${maxDetections}. `
+\n        `Should be > 0`);\n    }\n\n    if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n        throw new Error(\n

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`Invalid scoreThreshold ${scoreThreshold}.` +n    `Should be in range [0.0, 1.0]`);n }n\n if (nmsRadius <= 0)
{n throw new Error(`Invalid nmsRadius ${nmsRadius}.`);n }n}\n\nfunction
validateMultiPersonInstanceInferenceConfig(\n config: MultiPersonInstanceInferenceConfig) {\n const {\n
segmentationThreshold,\n maxDetections,\n scoreThreshold,\n nmsRadius,\n minKeypointScore,\n
refineSteps\n } = config;\n\n if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {\n throw new
Error(\n    `segmentationThreshold ${segmentationThreshold}.` +n    `Should be in range [0.0, 1.0]`);n
}\n\n if (maxDetections <= 0) {\n throw new Error(\n    `Invalid maxDetections ${maxDetections}.` +n
`Should be > 0`);n }\n\n if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n throw new Error(\n    `Invalid
scoreThreshold ${scoreThreshold}.` +n    `Should be in range [0.0, 1.0]`);n }\n\n if (nmsRadius <= 0) {\n
throw new Error(`Invalid nmsRadius ${nmsRadius}.`);n }\n\n if (minKeypointScore < 0 || minKeypointScore > 1)
{\n throw new Error(\n    `Invalid minKeypointScore ${minKeypointScore}.` +n    `Should be in range [0.0,
1.0]`);n }\n\n if (refineSteps <= 0 || refineSteps > 20) {\n throw new Error(\n    `Invalid refineSteps
${refineSteps}.` +n    `Should be in range [1, 20]`);n }\n}\n\nexport class BodyPix {\n baseModel:
BaseModel;\n\n constructor(net: BaseModel) {\n this.baseModel = net;\n }\n\n private
predictForPersonSegmentation(input: tf.Tensor3D): {\n segmentLogits: tf.Tensor3D,\n heatmapScores:
tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n }
{\n const {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n
} = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n heatmapScores,\n
offsets,\n displacementFwd,\n displacementBwd,\n };n }\n\n private
predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n segmentLogits: tf.Tensor3D,\n
partHeatmapLogits: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd:
tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n } {\n const {\n segmentation,\n partHeatmaps,\n
heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = this.baseModel.predict(input);\n
return {\n segmentLogits: segmentation,\n partHeatmapLogits: partHeatmaps,\n heatmapScores,\n
offsets,\n displacementFwd,\n displacementBwd,\n };n }\n\n private
predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n {\n segmentLogits:
tf.Tensor3D,\n longOffsets: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n
displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n partHeatmaps: tf.Tensor3D\n } {\n
const {\n segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n
displacementBwd,\n partHeatmaps,\n } = this.baseModel.predict(input);\n return {\n segmentLogits:
segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n
partHeatmaps\n };n }\n\n /**\n * Given an image with people, returns a dictionary of all intermediate\n *
tensors including: 1) a binary array with 1 for the pixels that are part of\n * the
person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.\n *n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed
through the network.\n *n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that
the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the
cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value
between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n
*\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered
part of the person. Affects the generation of the\n * segmentation mask.\n *n * @return A dictionary containing
`segmentation`, `heatmapScores`, `offsets`,\n * and `padding`:\n * - `segmentation`: A 2d Tensor with
1 for the pixels that are part of the\n * person, and 0 otherwise. The width and height correspond to the same\n *
dimensions of the input image.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * pose
estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by pose\n * estimation decoding.\n
* - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used\n * by pose estimation decoding.\n
* - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by pose estimation
decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n * before it is fed into the

```

```

model.\n */\n segmentPersonActivation(\n  input: BodyPixInput, internalResolution:
BodyPixInternalResolution,\n  segmentationThreshold = 0.5): {\n  segmentation: tf.Tensor2D,\n  heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd: tf.Tensor3D,\n  displacementBwd:
tf.Tensor3D,\n
padding: Padding,\n  internalResolutionHeightAndWidth: [number, number]\n } {\n  const [height, width] =
getInputSize(input);\n  const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n
internalResolution, this.baseModel.outputStride, [height, width]);\n  const {resized, padding} =\n  padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n  const {\n  segmentation,\n  heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd\n } = tf.tidy(() => {\n  const {\n  segmentLogits,\n  heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd\n } =
this.predictForPersonSegmentation(resized);\n\n  const [resizedHeight, resizedWidth] = resized.shape;\n\n  const scaledSegmentScores = scaleAndCropToInputTensorShape(\n  segmentLogits, [height, width],
[resizedHeight, resizedWidth],\n  [[padding.top, padding.bottom], [padding.left, padding.right]],\n
APPLY_SIGMOID_ACTIVATION);\n\n  return {\n  segmentation: toMaskTensor(\n
tf.squeeze(scaledSegmentScores), segmentationThreshold),\n  heatmapScores,\n  offsets,\n
displacementFwd,\n  displacementBwd,\n  });\n });\n  resized.dispose();\n  return {\n  segmentation,\n
heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd,\n  padding,\n
internalResolutionHeightAndWidth\n  });\n }\n\n /**\n * Given an image with many people, returns a
PersonSegmentation dictionary\n * that contains the segmentation mask for all people and a single pose.\n *
Note: The segmentation mask returned by this method covers all people but\n * the pose works well for one
person. If you want to estimate instance-level\n * multiple person segmentation & pose for each person, use\n *
`segmentMultiPerson` instead.\n *
@param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n
* The input image to feed through the network.\n *
@param config PersonInferenceConfig object that
contains\n * parameters for the BodyPix inference using person decoding.\n *
@return A
SemanticPersonSegmentation dictionary that contains height,\n * width, the flattened binary segmentation mask
and the poses for all people.\n * The width and height correspond to the same dimensions of the input image.\n *
`height`: The height of the segmentation data in pixel unit.\n *
`width`: The width of the segmentation data in
pixel unit.\n *
`data`: The flattened Uint8Array of segmentation data. 1 means the pixel\n * belongs to a person
and 0 means the pixel doesn't belong to a person. The\n * size of the array is equal to `height` x `width` in row-
major order.\n *
`allPoses`: The 2d poses of all people.\n */\n async segmentPerson(\n  input:
BodyPixInput,\n  config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n
Promise<SemanticPersonSegmentation> {\n  config = {...PERSON_INFERENCE_CONFIG, ...config};\n\n  validatePersonInferenceConfig(config);\n\n  const {\n  segmentation,\n  heatmapScores,\n  offsets,\n
displacementFwd,\n  displacementBwd,\n  padding,\n  internalResolutionHeightAndWidth\n } =\n  this.segmentPersonActivation(\n  input, config.internalResolution, config.segmentationThreshold);\n\n  const [height, width] = segmentation.shape;\n\n  const result = await segmentation.data() as Uint8Array;\n  segmentation.dispose();\n\n  const tensorBuffers = await toTensorBuffers3D(\n  [heatmapScores, offsets,
displacementFwd, displacementBwd]);\n  const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =\n  tensorBuffers;\n\n  let poses = decodeMultiplePoses(\n  scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n  this.baseModel.outputStride, config.maxDetections,\n
config.scoreThreshold,\n
config.nmsRadius);\n\n  poses = scaleAndFlipPoses(\n  poses, [height, width],
internalResolutionHeightAndWidth, padding,\n  FLIP_POSES_AFTER_SCALING);\n\n  heatmapScores.dispose();\n  offsets.dispose();\n  displacementFwd.dispose();\n  displacementBwd.dispose();\n\n  return {height, width, data: result, allPoses: poses};\n }\n\n /**\n * Given an image with multiple people, returns
an *array* of\n * PersonSegmentation object. Each element in the array corresponding to one\n * of the people in
the input image. In other words, it predicts\n * instance-level multiple person segmentation & pose for each

```

person.
 * The model does standard ImageNet pre-processing before inferring through the model. The image pixels should have values [0-255].
 * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed through the network.
 * @param config MultiPersonInferenceConfig object that contains parameters for the BodyPix inference using multi-person decoding.
 * @return An array of PersonSegmentation object, each containing a width, height, a binary array (1 for the pixels that are part of the person, and 0 otherwise) and 2D pose. The array size corresponds to the number of pixels in the image. The width and height correspond to the dimensions of the image the binary array is shaped to, which are the same dimensions of the input image.
 async segmentMultiPerson(input: BodyPixInput, config: MultiPersonInstanceInferenceConfig) = MULTI_PERSON_INSTANCE_INFERENCE_CONFIG);
 Promise<PersonSegmentation[]> {
 config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};
 validateMultiPersonInstanceInferenceConfig(config);
 const [height, width] = getInputSize(input);
 const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(config.internalResolution, this.baseModel.outputStride, [height, width]);
 const {resized, padding} = padAndResizeTo(input, internalResolutionHeightAndWidth);
 const {segmentation, longOffsets, heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw, } = tf.tidy(() => {
 const {segmentLogits, longOffsets, heatmapScores, offsets, displacementFwd, displacementBwd, } = this.predictForMultiPersonInstanceSegmentationAndPart(resized);
 const scaledSegmentScores = scaleAndCropToInputTensorShape(segmentLogits, [height, width], internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]], APPLY_SIGMOID_ACTIVATION);
 const longOffsetsResized = false;
 let scaledLongOffsets;
 if (longOffsetsResized) {
 scaledLongOffsets = scaleAndCropToInputTensorShape(longOffsets, [height, width], internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]], APPLY_SIGMOID_ACTIVATION);
 } else {
 scaledLongOffsets = longOffsets;
 }
 const segmentation = toMaskTensor(tf.squeeze(scaledSegmentScores), config.segmentationThreshold);
 return {segmentation, longOffsets: scaledLongOffsets, heatmapScoresRaw: heatmapScores, offsetsRaw: offsets, displacementFwdRaw: displacementFwd, displacementBwdRaw: displacementBwd, };
 });
 const tensorBuffers = await toTensorBuffers3D([heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);
 const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] = tensorBuffers;
 let poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf, this.baseModel.outputStride, config.maxDetections, config.scoreThreshold, config.nmsRadius);
 poses = scaleAndFlipPoses(poses, [height, width], internalResolutionHeightAndWidth, padding, FLIP_POSES_AFTER_SCALING);
 const instanceMasks = await decodePersonInstanceMasks(segmentation, longOffsets, poses, height, width, this.baseModel.outputStride, internalResolutionHeightAndWidth, padding, config.scoreThreshold, config.refineSteps, config.minKeypointScore, config.maxDetections);
 resized.dispose();
 segmentation.dispose();
 longOffsets.dispose();
 heatmapScoresRaw.dispose();
 offsetsRaw.dispose();
 displacementFwdRaw.dispose();
 displacementBwdRaw.dispose();
 return instanceMasks; }
 }
 /**
 * Given an image with many people, returns a dictionary containing: height, width, a tensor with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise. This does standard ImageNet pre-processing before inferring through the model. The image should pixels should have values [0-255].
 * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed through the network.
 * @param internalResolution Defaults to 'medium'. The internal resolution percentage that the input is resized to before inference. The larger the internalResolution the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or a

percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.

`@param segmentationThreshold` The minimum that segmentation values must have to be considered part of the person. Affects the clipping of the colored part image.

`@return` A dictionary

containing `partSegmentation`, `heatmapScores`, `offsets`, and `padding`.

`partSegmentation`: A 2d Tensor with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise.

`heatmapScores`: A 3d Tensor of the keypoint heatmaps used by single-person pose estimation decoding.

`offsets`: A 3d Tensor of the keypoint offsets used by single-person pose estimation decoding.

`displacementFwd`: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding.

`displacementBwd`: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding.

`padding`: The padding (unit pixels) being applied to the input image before it is fed into the model.

`segmentPersonPartsActivation`(`input: BodyPixInput`, `internalResolution: BodyPixInternalResolution`, `segmentationThreshold = 0.5`):

```
{
  partSegmentation: tf.Tensor2D,
  heatmapScores: tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
  padding: Padding,
  internalResolutionHeightAndWidth: [number, number]
}
const [height, width] = getInputSize(input);
const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(
  internalResolution, this.baseModel.outputStride, [height, width]);
const [resized, padding] = padAndResizeTo(input, internalResolutionHeightAndWidth);
const [partSegmentation, heatmapScores, offsets, displacementFwd, displacementBwd] =
tf.tidy(() => {
  const [segmentLogits, partHeatmapLogits, heatmapScores, offsets, displacementFwd, displacementBwd] =
this.predictForPersonSegmentationAndPart(resized);
  const [resizedHeight, resizedWidth] = resized.shape;
  const scaledSegmentScores =
scaleAndCropToInputTensorShape(
  segmentLogits, [height, width], [resizedHeight, resizedWidth],
[[padding.top, padding.bottom], [padding.left, padding.right]],
  APPLY_SIGMOID_ACTIVATION);
  const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(
  partHeatmapLogits, [height, width],
[resizedHeight, resizedWidth],
[[padding.top, padding.bottom], [padding.left, padding.right]],
  APPLY_SIGMOID_ACTIVATION);
  const segmentation =
toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);
  return {
    partSegmentation:
decodePartSegmentation(segmentation, scaledPartHeatmapScore),
    heatmapScores,
    offsets,
    displacementFwd,
    displacementBwd,
  };
});
resized.dispose();
return {
  partSegmentation,
  heatmapScores,
  offsets,
  displacementFwd,
  displacementBwd,
  padding,
  internalResolutionHeightAndWidth
};
}
```

Given an image with many people, returns a `PartSegmentation` dictionary that contains the body part segmentation mask for all people and a single pose. Note: The body part segmentation mask returned by this method covers all people but the pose works well when there is one person. If you want to estimate instance-level multiple person body part segmentation & pose for each person, use

`segmentMultiPersonParts` instead.

`@param input`

`ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement` The input image to feed through the network.

`@param config` `PersonInferenceConfig` object that contains parameters for the `BodyPix` inference using single person decoding.

`@return` A `SemanticPartSegmentation` dictionary that contains height, width, the flattened binary segmentation mask and the pose for the person. The width and height correspond to

the same dimensions of the input image.

`height`: The height of the person part segmentation data in pixel unit.

`width`: The width of the person part segmentation data in pixel unit.

`data`: The flattened `Int32Array` of person part segmentation data with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise. The size of the array is equal to `height` x `width` in row-major order.

`allPoses`: The 2d poses of all people.

`async segmentPersonParts`(`input: BodyPixInput`, `config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG`):


```

Promise<SemanticPartSegmentation> {\n  config = {...PERSON_INFERENCE_CONFIG, ...config};\n\n  validatePersonInferenceConfig(config);\n  const {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n  } =\n  this.segmentPersonPartsActivation(\n    input, config.internalResolution, config.segmentationThreshold);\n\n  const [height, width] =\n  partSegmentation.shape;\n  const data = await partSegmentation.data() as Int32Array;\n  partSegmentation.dispose();\n\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScores, offsets,\n    displacementFwd, displacementBwd]);\n  const [scoresBuf, offsetsBuf, displacementsFwdBuf,\n    displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf,\n    displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride, config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n\n  poses = scaleAndFlipPoses(\n    poses, [height, width],\n    internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\n  heatmapScores.dispose();\n  offsets.dispose();\n  displacementFwd.dispose();\n  displacementBwd.dispose();\n\n  return {height, width, data,\n    allPoses: poses};\n  }\n\n  /**\n   * Given an image with multiple people, returns an *array* of PartSegmentation\n   * object. Each element in the array corresponding to one\n   * of the people in the input image. In other words, it\n   * predicts\n   * instance-level multiple person body part segmentation & pose for each\n   * person.\n   *\n   * This\n   * does standard ImageNet pre-processing before inferring through\n   * the model. The image pixels should have\n   * values [0-255].\n   *\n   * @param input\n   * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n   * image to feed\n   * through the network.\n   *\n   * @param config MultiPersonInferenceConfig object that contains\n   * parameters for\n   * the BodyPix inference using multi-person decoding.\n   *\n   * @return An array of PartSegmentation object, each\n   * containing a width,\n   * height, a flattened array (with part id from 0-24 for the pixels that are\n   * part of a\n   * corresponding body part, and -1 otherwise) and 2D pose.\n\n   * The width\n   * and height correspond to the dimensions of the image. Each flattened part\n   * segmentation array\n   * size is equal to `height` x `width`.\n   */\n  async segmentMultiPersonParts(\n    input: BodyPixInput,\n    config:\n    MultiPersonInstanceInferenceConfig =\n      MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):\n    Promise<PartSegmentation[]> {\n      config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,\n        ...config};\n\n      validateMultiPersonInstanceInferenceConfig(config);\n      const [height, width] =\n        getInputSize(input);\n      const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n        config.internalResolution, this.baseModel.outputStride,\n        [height, width]);\n      const {resized, padding} =\n        padAndResizeTo(input, internalResolutionHeightAndWidth);\n      const {\n        segmentation,\n        longOffsets,\n        heatmapScoresRaw,\n        offsetsRaw,\n        displacementFwdRaw,\n        displacementBwdRaw,\n        partSegmentation,\n      } = tf.tidy(()\n        => {\n          const {\n            segmentLogits,\n            longOffsets,\n            heatmapScores,\n            offsets,\n            displacementFwd,\n            displacementBwd,\n            partHeatmaps\n          } =\n            this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n\n          // decoding with scaling.\n          const\n            scaledSegmentScores = scaleAndCropToInputTensorShape(\n              segmentLogits, [height, width],\n              internalResolutionHeightAndWidth,\n              [[padding.top, padding.bottom], [padding.left, padding.right]],\n              APPLY_SIGMOID_ACTIVATION);\n\n          // decoding with scaling.\n          const scaledPartSegmentationScores =\n            scaleAndCropToInputTensorShape(\n              partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n              [[padding.top, padding.bottom], [padding.left, padding.right]],\n              APPLY_SIGMOID_ACTIVATION);\n\n          const scaledLongOffsets = longOffsets;\n          const segmentation = toMaskTensor(\n            tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n\n          const partSegmentation =\n            decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n\n          return {\n            segmentation,\n            longOffsets: scaledLongOffsets,\n            heatmapScoresRaw: heatmapScores,\n            offsetsRaw: offsets,\n            displacementFwdRaw: displacementFwd,\n            displacementBwdRaw:\n            displacementBwd,\n            partSegmentation\n          };
        });\n\n      const tensorBuffers = await toTensorBuffers3D(\n

```

```

[heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf,
offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses =
decodeMultiplePoses(\n    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\nthis.baseModel.outputStride, config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n\n  poses =
scaleAndFlipPoses(\n    poses, [height, width], internalResolutionHeightAndWidth, padding,\nFLIP_POSES_AFTER_SCALING);\n\n  const instanceMasks = await decodePersonInstancePartMasks(\n    segmentation, longOffsets,
partSegmentation, poses, height, width,\n    this.baseModel.outputStride, internalResolutionHeightAndWidth,
padding,\n    config.scoreThreshold, config.refineSteps, config.minKeypointScore,\nconfig.maxDetections);\n\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n  partSegmentation.dispose();\n\n  return instanceMasks;\n  }\n\n  public
dispose() {\n    this.baseModel.dispose();\n  }\n\n  /**\n   * Loads the MobileNet BodyPix model.\n   */\n  async
function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n    const outputStride = config.outputStride;\n    const quantBytes = config.quantBytes;\n    const multiplier = config.multiplier;\n    if (tf == null) {\n      throw new
Error(\n        `Cannot
find TensorFlow.js. If you are using a <script> tag, please ` +\n        `also include @tensorflow/tfjs on the page
before using this\n        model.`);\n    }\n\n    const url = mobileNetSavedModel(outputStride, multiplier,
quantBytes);\n    const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n    const mobilenet = new
MobileNet(graphModel, outputStride);\n    return new BodyPix(mobilenet);\n  }\n\n  /**\n   * Loads the ResNet BodyPix
model.\n   */\n  async function loadResNet(config: ModelConfig): Promise<BodyPix> {\n    const outputStride =
config.outputStride;\n    const quantBytes = config.quantBytes;\n    if (tf == null) {\n      throw new Error(\n
`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n      `also include @tensorflow/tfjs on the
page before using this\n      model.`);\n    }\n\n    const url = resNet50SavedModel(outputStride, quantBytes);\n    const
graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n    const resnet = new ResNet(graphModel,
outputStride);\n    return new BodyPix(resnet);\n  }\n\n  /**\n   * Loads the BodyPix model instance from a checkpoint,
with the ResNet\n   * or MobileNet architecture. The model to be loaded is configurable using the\n   * config
dictionary ModelConfig. Please find more details in the\n   * documentation of the ModelConfig.\n   */\n  @param
config ModelConfig dictionary that contains parameters for\n   * the BodyPix loading process. Please find more
details of each parameters\n   * in the documentation of the ModelConfig interface. The predefined\n   *
`MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n   * for defining your
customized config.\n   */\n  export async function load(config: ModelConfig = MOBILENET_V1_CONFIG):\n  Promise<BodyPix> {\n    config = validateModelConfig(config);\n    if (config.architecture === 'ResNet50') {\n      return
loadResNet(config);\n    } else if (config.architecture === 'MobileNetV1') {\n      return
loadMobileNet(config);\n    } else {\n      return null;\n    }\n  }\n\n  }\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache
License, Version 2.0 (the `License`);\n   * you may not use this file except in compliance with the License.\n   * You
may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required
by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an `AS IS`\n
BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the
License for the specific language governing permissions and\n   * limitations under the License.\n   */\n  =====\n\n  /**\n   */\n  // method copied from bGlu in https://codepen.io/zhaojun/pen/zZmRQe\n  export function cpuBlur(\n  canvas: HTMLCanvasElement|OffscreenCanvas,\n  image:
HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n  blur: number) {\n    const
ctx = canvas.getContext('2d');\n\n    let sum = 0;\n    const delta = 5;\n    const alphaLeft = 1 / (2 * Math.PI * delta * delta);\n    const step = blur < 3 ? 1 :
2;\n    for (let y = -blur; y <= blur; y += step) {\n      for (let x = -blur; x <= blur; x += step) {\n        const weight =\n

```

```

alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n    sum += weight;\n    }\n    }\n    for (let y = -blur; y <=
blur; y += step) {\n    for (let x = -blur; x <= blur; x += step) {\n    ctx.globalAlpha = alphaLeft *\nMath.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n    ctx.drawImage(image, x, y);\n    }\n    }\n
ctx.globalAlpha = 1;\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from
 './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}
from './util';\n\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst offScreenCanvases:
 {[name: string]: Canvas} = {};\n\ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\ntype
HasDimensions = {\n width: number,\n height: number\n};\n\nfunction isSafari() {\n return
(/^(?!chrome|android).*safari/i.test(navigator.userAgent));\n}\n\nfunction assertSameDimensions(\n {width:
widthA,
height: heightA}: HasDimensions,\n {width: widthB, height: heightB}: HasDimensions, nameA: string,\n
nameB: string) {\n if (widthA !== widthB || heightA !== heightB) {\n throw new Error(`error: dimensions must
match. ${nameA} has dimensions ${\n widthA}x${heightA}, ${nameB} has dimensions
${widthB}x${heightB}`);\n }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n const ctx =
canvas.getContext('2d');\n ctx.scale(-1, 1);\n ctx.translate(-canvas.width, 0);\n}\n\nfunction
drawWithCompositing(\n ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n image:
Canvas|ImageType,\n compositeOperation: string) {\n ctx.globalCompositeOperation = compositeOperation;\n
ctx.drawImage(image, 0, 0);\n}\n\nfunction createOffScreenCanvas(): Canvas {\n if (typeof document !==
'undefined') {\n return document.createElement('canvas');\n } else if (typeof OffscreenCanvas !== 'undefined')
{\n return new OffscreenCanvas(0, 0);\n } else {\n throw
new Error('Cannot create a canvas in this context');\n }\n}\n\nfunction ensureOffscreenCanvasCreated(id: string):
Canvas {\n if (!offScreenCanvases[id]) {\n offScreenCanvases[id] = createOffScreenCanvas();\n }\n return
offScreenCanvases[id];\n}\n\nfunction drawAndBlurImageOnCanvas(\n image: ImageType, blurAmount:
number, canvas: Canvas) {\n const {height, width} = image;\n const ctx = canvas.getContext('2d');\n canvas.width
= width;\n canvas.height = height;\n ctx.clearRect(0, 0, width, height);\n ctx.save();\n if (isSafari()) {\n
cpuBlur(canvas, image, blurAmount);\n } else {\n // tslint:disable:no-any\n (ctx as any).filter =
`blur(${blurAmount}px)`;\n ctx.drawImage(image, 0, 0, width, height);\n }\n ctx.restore();\n}\n\nfunction
drawAndBlurImageOnOffScreenCanvas(\n image: ImageType, blurAmount: number,\n offscreenCanvasName:
string): Canvas {\n const canvas = ensureOffscreenCanvasCreated(offscreenCanvasName);\n if (blurAmount ===
0) {\n renderImageToCanvas(image,
canvas);\n } else {\n drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n }\n return
canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n const {width, height} =
image;\n canvas.width = width;\n canvas.height = height;\n const ctx = canvas.getContext('2d');\n\n
ctx.drawImage(image, 0, 0, width, height);\n}\n\n/*\n * Draw an image on a canvas\n *\nfunction
renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n canvas.width = image.width;\n canvas.height
= image.height;\n const ctx = canvas.getContext('2d');\n\n ctx.putImageData(image, 0, 0);\n}\n\nfunction
renderImageDataToOffScreenCanvas(\n image: ImageData, canvasName: string): Canvas {\n const canvas =
ensureOffscreenCanvasCreated(canvasName);\n renderImageDataToCanvas(image, canvas);\n\n return
canvas;\n}\n\n/*\n * Given the output from estimating multi-person segmentation, generates an\n * image with
foreground and background color at each pixel determined

```

by the corresponding binary segmentation value at the pixel from the output. In other words, pixels where there is a person will be colored with foreground color and where there is not a person will be colored with background color.

`@param personOrPartSegmentation` The output from `segmentPerson``, `segmentMultiPerson``, `segmentPersonParts`` or `segmentMultiPersonParts``. They can be `SemanticPersonSegmentation` object, an array of `PersonSegmentation` object, `SemanticPartSegmentation` object, or an array of `PartSegmentation` object.

`@param foreground` Default to `{r:0, g:0, b:0, a: 0}`. The foreground color `(r,g,b,a)` for visualizing pixels that belong to people.

`@param background` Default to `{r:0, g:0, b:0, a: 255}`. The background color `(r,g,b,a)` for visualizing pixels that don't belong to people.

`@param drawContour` Default to `false`. Whether to draw the contour around each person's segmentation mask or body part mask.

`@param foregroundIds` Default to `[1]`. The integer values that represent foreground. For person segmentation, 1 is the foreground. For body part segmentation, it can be a subset of all body parts ids.

`@returns` An `ImageData` with the same width and height of all the `PersonSegmentation` in `multiPersonSegmentation`, with opacity and transparency at each pixel determined by the corresponding binary segmentation value at the pixel from the output.

```

export function toMask(
  personOrPartSegmentation:
  SemanticPersonSegmentation|
  SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],
  foreground: Color = {r: 0, g: 0, b: 0, a: 0},
  background: Color = {r: 0, g: 0, b: 0, a: 255},
  drawContour = false, foregroundIds: number[] = [1]): ImageData {
  if (Array.isArray(personOrPartSegmentation) &&
    personOrPartSegmentation.length === 0) return null;
  let multiPersonOrPartSegmentation:
    Array<SemanticPersonSegmentation|SemanticPartSegmentation|
    PersonSegmentation|PartSegmentation>;
  if (!Array.isArray(personOrPartSegmentation)) {
    multiPersonOrPartSegmentation = [personOrPartSegmentation];
  } else {
    multiPersonOrPartSegmentation =
    personOrPartSegmentation;
  }
  const {width, height} = multiPersonOrPartSegmentation[0];
  const bytes =
  new Uint8ClampedArray(width * height * 4);
  function drawStroke(
    bytes: Uint8ClampedArray, row:
    number, column: number, width: number,
    radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {
    for (let i = -radius; i <= radius; i++)
      for (let j = -radius; j <= radius; j++)
        if (i !== 0 && j !== 0) {
          const n = (row + i) * width + (column + j);
          bytes[4 * n + 0] = color.r;
          bytes[4 * n + 1] = color.g;
          bytes[4 * n + 2] = color.b;
          bytes[4 * n + 3] = color.a;
        }
  }
  function isSegmentationBoundary(
    segmentationData: Uint8Array|Int32Array,
    row: number,
    column: number,
    width: number,
    foregroundIds: number[] = [1],
    radius = 1,
  ): boolean {
    let numberBackgroundPixels = 0;
    for (let i = -radius; i <= radius; i++)
      for (let j = -radius; j <= radius; j++)
        if (i !== 0 && j !== 0) {
          const n = (row + i) * width + (column + j);
          if (!foregroundIds.some(id => id === segmentationData[n]))
            numberBackgroundPixels += 1;
        }
  }
  return numberBackgroundPixels > 0;
  for (let i = 0; i < height; i += 1)
    for (let j = 0; j < width; j += 1) {
      const n = i * width + j;
      bytes[4 * n + 0] = background.r;
      bytes[4 * n + 1] =
      background.g;
      bytes[4 * n + 2] = background.b;
      bytes[4 * n + 3] = background.a;
      for (let k = 0; k <
      multiPersonOrPartSegmentation.length;
      k++)
        if (foregroundIds.some(
          id => id === multiPersonOrPartSegmentation[k].data[n]))
          bytes[4 * n] = foreground.r;
          bytes[4 * n + 1] = foreground.g;
          bytes[4 * n + 2] = foreground.b;
          bytes[4 * n + 3] = foreground.a;
          const isBoundary = isSegmentationBoundary(
            multiPersonOrPartSegmentation[k].data, i, j, width,
            foregroundIds);
          if (drawContour && i - 1 >= 0
            && i + 1 < height && j - 1 >= 0 &&
            j + 1 < width && isBoundary)
            drawStroke(bytes, i, j,
            width, 1);
    }
  }
  return new ImageData(bytes, width, height);
}
const RAINBOW_PART_COLORS: Array<[number, number, number]> = [
  [110, 64, 170], [143, 61, 178], [178, 60,
  178], [210, 62, 167], [238, 67, 149], [255, 78, 125], [255, 94, 99], [255, 115, 75], [255, 140, 56], [239, 167,
  47], [217, 194, 49], [194, 219, 64],
  [175, 240, 91], [135, 245, 87], [96, 247, 96], [64, 243, 115], [40, 234, 141], [28, 219, 169], [26, 199, 194], [33,
  176, 213], [47, 150, 224], [65, 125, 224], [84, 101, 214], [99, 81, 195]];

```

`* Given the output from`

person body part segmentation (or multi-person\n * instance body part segmentation) and an array of colors indexed by part id,\n * generates an image with the corresponding color for each part at each pixel,\n * and white pixels where there is no part.\n * \n * @param partSegmentation The output from segmentPersonParts\n * or segmentMultiPersonParts. The former is a SemanticPartSegmentation\n * object and later is an array of PartSegmentation object.\n * \n * @param partColors A multi-dimensional array of rgb colors indexed by\n * part id. Must have 24 colors, one for every part.\n * \n * @returns An ImageData with the same width and height of all the element in\n * multiPersonPartSegmentation, with the corresponding color for each part at\n * each pixel, and black pixels where there is no part.\n * \n * ^\n * export function toColoredPartMask(\n * partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n * partColors: Array<[number, number, number]> =\n * RAINBOW_PART_COLORS): ImageData {\n * if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n * return null;\n * }\n * \n * let multiPersonPartSegmentation;\n * if (!Array.isArray(partSegmentation)) {\n * multiPersonPartSegmentation = [partSegmentation];\n * } else {\n * multiPersonPartSegmentation = partSegmentation;\n * }\n * \n * const {width, height} = multiPersonPartSegmentation[0];\n * const bytes = new Uint8ClampedArray(width * height * 4);\n * \n * for (let i = 0; i < height * width; ++i) {\n * // invert mask. Invert the segmentation mask.\n * const j = i * 4;\n * bytes[j + 0] = 255;\n * bytes[j + 1] = 255;\n * bytes[j + 2] = 255;\n * bytes[j + 3] = 255;\n * for (let k = 0; k < multiPersonPartSegmentation.length; k++) {\n * const partId = multiPersonPartSegmentation[k].data[i];\n * \n * if (partId !== -1) {\n * const color = partColors[partId];\n * if (!color) {\n * throw new Error(`No color could be found for part id \${partId}`);\n * }\n * bytes[j + 0] = color[0];\n * bytes[j + 1] = color[1];\n * bytes[j + 2] = color[2];\n * bytes[j + 3] = 255;\n * }\n * }\n * }\n * \n * return new ImageData(bytes, width, height);\n * }\n * \n * const CANVAS_NAMES = {\n * blurred: 'blurred',\n * blurredMask: 'blurred-mask',\n * mask: 'mask',\n * lowresPartMask: 'lowres-part-mask',\n *};\n * \n * \n * \n * Given an image and a maskImage of type ImageData, draws the image with the\n * mask on top of it onto a canvas.\n * \n * \n * @param canvas The canvas to be drawn onto.\n * \n * \n * @param image The original image to apply the mask to.\n * \n * \n * @param maskImage An ImageData containing the mask. Ideally this should be\n * generated by toMask or toColoredPartMask.\n * \n * \n * @param maskOpacity The opacity of the mask when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n * \n * \n * @param maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * \n * \n * Should be an integer between 0 and 20.\n * \n * \n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n * \n * \n * ^\n * export function drawMask(\n * canvas: Canvas, image: ImageType, maskImage: ImageData|null,\n * maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false) {\n * const [height, width] = getInputSize(image);\n * canvas.width = width;\n * canvas.height = height;\n * \n * const ctx = canvas.getContext('2d');\n * ctx.save();\n * if (flipHorizontal) {\n * flipCanvasHorizontal(canvas);\n * }\n * \n * ctx.drawImage(image, 0, 0);\n * \n * ctx.globalAlpha = maskOpacity;\n * if (maskImage) {\n * assertSameDimensions({width, height}, maskImage, 'image', 'mask');\n * const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n * const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n * mask, maskBlurAmount, CANVAS_NAMES.blurredMask);\n * ctx.drawImage(blurredMask, 0, 0, width, height);\n * }\n * \n * ctx.restore();\n * }\n * \n * \n * \n * Given an image and a maskImage of type ImageData, draws the image with the\n * pixelated mask on top of it onto a canvas.\n * \n * \n * @param canvas The canvas to be drawn onto.\n * \n * \n * @param image The original image to apply the mask to.\n * \n * \n * @param maskImage An ImageData containing the mask. Ideally this should be\n * generated by toColoredPartMask.\n * \n * \n * @param maskOpacity The opacity of the mask when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n * \n * \n * @param maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * \n * \n * Should be an integer between 0 and 20.\n * \n * \n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n * \n * \n * @param pixelCellWidth The width of each pixel cell. Default to 10 px.\n * \n * \n * ^\n * export function drawPixelatedMask(\n * canvas: Canvas, image: ImageType, maskImage: ImageData,\n * maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n * pixelCellWidth = 10.0) {\n * const [height, width] = getInputSize(image);\n * assertSameDimensions({width, height}, maskImage,

```

'image', 'mask');\n\n const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n  mask, maskBlurAmount,\n  CANVAS_NAMES.blurredMask);\n\n canvas.width = blurredMask.width;\n canvas.height =\n blurredMask.height;\n\n const ctx = canvas.getContext('2d');\n ctx.save();\n if (flipHorizontal) {\n flipCanvasHorizontal(canvas);\n }\n\n const offscreenCanvas =\n ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n const offscreenCanvasCtx =\n offscreenCanvas.getContext('2d');\n offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n offscreenCanvasCtx.drawImage(\n blurredMask, 0, 0, blurredMask.width,\n blurredMask.height, 0, 0,\n offscreenCanvas.width, offscreenCanvas.height);\n ctx.imageSmoothingEnabled =\n false;\n ctx.drawImage(\n offscreenCanvas, 0, 0, offscreenCanvas.width, offscreenCanvas.height, 0,\n 0,\n canvas.width, canvas.height);\n\n // Draws vertical grid lines that are `pixelCellWidth` apart from each other.\n for\n (let i = 0; i < offscreenCanvas.width; i++) {\n ctx.beginPath();\n ctx.strokeStyle = '#ffffff';\n ctx.moveTo(pixelCellWidth * i, 0);\n ctx.lineTo(pixelCellWidth * i, canvas.height);\n ctx.stroke();\n }\n\n //\n Draws horizontal grid lines that are `pixelCellWidth` apart from each\n // other.\n for (let i = 0; i <\n offscreenCanvas.height; i++) {\n ctx.beginPath();\n ctx.strokeStyle = '#ffffff';\n ctx.moveTo(0, pixelCellWidth\n * i);\n ctx.lineTo(canvas.width, pixelCellWidth * i);\n ctx.stroke();\n }\n\n ctx.globalAlpha = 1.0 -\n maskOpacity;\n ctx.drawImage(image, 0, 0, blurredMask.width, blurredMask.height);\n\n ctx.restore();\n }\n\n function createPersonMask(\n multiPersonSegmentation:\n PersonSegmentation[] | SemanticPersonSegmentation,\n edgeBlurAmount: number): Canvas {\n const\n backgroundMaskImage = toMask(\n multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n {r: 0, g: 0, b: 0, a:\n 0});\n\n const backgroundMask =\n renderImageDataToOffScreenCanvas(backgroundMaskImage,\n CANVAS_NAMES.mask);\n\n if (edgeBlurAmount === 0) {\n return backgroundMask;\n } else {\n return\n drawAndBlurImageOnOffScreenCanvas(\n backgroundMask, edgeBlurAmount,\n CANVAS_NAMES.blurredMask);\n }\n }\n\n /**\n * Given a personSegmentation and an image, draws the image\n * with its background\n * blurred onto the canvas.\n * @param canvas The canvas to draw the background-blurred\n * image onto.\n * @param image The image to blur the background of and draw.\n * @param\n * personSegmentation A SemanticPersonSegmentation or an array of\n * PersonSegmentation object.\n * @param\n * backgroundBlurAmount\n * How many pixels in the background blend into each\n * other. Defaults to 3. Should be an integer between 1 and\n * 20.\n * @param edgeBlurAmount How many pixels to blur on the edge between the person\n * and the\n * background by. Defaults to 3. Should be an integer between 0 and 20.\n * @param flipHorizontal If the output\n * should be flipped horizontally. Defaults\n * to false.\n */\n\n export function drawBokehEffect(\n canvas: Canvas,\n image: ImageType,\n multiPersonSegmentation: SemanticPersonSegmentation | PersonSegmentation[],\n backgroundBlurAmount = 3, edgeBlurAmount = 3, flipHorizontal = false) {\n const blurredImage =\n drawAndBlurImageOnOffScreenCanvas(\n image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n\n canvas.width = blurredImage.width;\n canvas.height = blurredImage.height;\n\n const ctx =\n canvas.getContext('2d');\n\n if (Array.isArray(multiPersonSegmentation) &&\n multiPersonSegmentation.length\n === 0) {\n ctx.drawImage(blurredImage,\n 0, 0);\n return;\n }\n\n const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n\n ctx.save();\n if (flipHorizontal) {\n flipCanvasHorizontal(canvas);\n }\n\n // draw the original image on the final\n canvas\n const [height, width] = getInputSize(image);\n ctx.drawImage(image, 0, 0, width, height);\n\n //\n \"destination-in\" - \"The existing canvas content is kept where both the\n // new shape and existing canvas content\n overlap. Everything else is made\n // transparent.\"\n // crop what's not the person using the mask from the original\n image\n drawWithCompositing(ctx, personMask, 'destination-in');\n //\n \"destination-over\" - \"The existing canvas\n content is kept where both the\n // new shape and existing canvas content overlap. Everything else is made\n //\n transparent.\"\n // draw the blurred background on top of the original image where it doesn't\n // overlap.\n drawWithCompositing(ctx, blurredImage, 'destination-over');\n ctx.restore();\n }\n\n function

```

```

createBodyPartMask(\n  multiPersonPartSegmentation: SemanticPartSegmentation|PartSegmentation[],\n
bodyPartIdsToMask: number[], edgeBlurAmount: number): Canvas {\n  const backgroundMaskImage = toMask(\n
  multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},\n    {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);\n\n
const backgroundMask =\n  renderImageDataToOffScreenCanvas(backgroundMaskImage,\n
CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n    return backgroundMask;\n  } else {\n    return
drawAndBlurImageOnOffScreenCanvas(\n    backgroundMask, edgeBlurAmount,\n
CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image
with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred
image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param
partSegmentation A SemanticPartSegmentation or an array of\n * PartSegmentation
object.\n *\n * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-face). An\n * array of body part ids
to blur. Each must be one of the 24 body part ids.\n *\n * @param backgroundBlurAmount How many pixels in the
background blend into each\n * other. Defaults to 3. Should be an integer between 1 and 20.\n *\n * @param
edgeBlurAmount How many pixels to blur on the edge between the person\n * and the background by. Defaults to
3. Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If the output should be flipped
horizontally. Defaults\n * to false.\n */\nexport function blurBodyPart(\n  canvas: Canvas, image: ImageType,\n
partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n  bodyPartIdsToBlur = [0, 1],\n
backgroundBlurAmount = 3, edgeBlurAmount = 3,\n  flipHorizontal = false) {\n  const blurredImage =
drawAndBlurImageOnOffScreenCanvas(\n    image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n\n
canvas.width = blurredImage.width;\n\n
  canvas.height = blurredImage.height;\n\n  const ctx = canvas.getContext('2d');\n\n  if
(Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n    ctx.drawImage(blurredImage, 0, 0);\n
return;\n  }\n  const bodyPartMask =\n    createBodyPartMask(partSegmentation, bodyPartIdsToBlur,\n
edgeBlurAmount);\n\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n  // draw the
original image on the final canvas\n  const [height, width] = getInputSize(image);\n  ctx.drawImage(image, 0, 0,\n
width, height);\n\n  // "destination-in" - "The existing canvas content is kept where both the\n // new shape and
existing canvas content overlap. Everything else is made\n // transparent."\n // crop what's not the person using the
mask from the original image\n  drawWithCompositing(ctx, bodyPartMask, 'destination-in');\n  // "destination-
over" - "The existing canvas content is kept where both the\n // new shape and existing canvas content overlap.
Everything else is made\n // transparent."\n // draw the blurred background on top of the original image where it
doesn't\n // overlap.\n  drawWithCompositing(ctx, blurredImage, 'destination-over');\n  ctx.restore();\n}\n\n"/**\n *
@license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0
(the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *\n
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n *\n
=====*\n\n
*/\nexport const PART_CHANNELS: string[] = [\n
  'left_face',\n  'right_face',\n  'left_upper_arm_front',\n  'left_upper_arm_back',\n  'right_upper_arm_front',\n
  'right_upper_arm_back',\n  'left_lower_arm_front',\n  'left_lower_arm_back',\n  'right_lower_arm_front',\n
  'right_lower_arm_back',\n  'left_hand',\n  'right_hand',\n  'torso_front',\n  'torso_back',\n  'left_upper_leg_front',\n
  'left_upper_leg_back',\n  'right_upper_leg_front',\n  'right_upper_leg_back',\n  'left_lower_leg_front',\n
  'left_lower_leg_back',\n  'right_lower_leg_front',\n  'right_lower_leg_back',\n  'left_feet',\n  'right_feet'];\n\n"/**\n *
@license See the LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\nconst version =
'2.2.0';\nexport
{version};\n\n},"names":["toFlattenedOneHotPartMap","partHeatmapScores","numParts","shape","partMapLocation
s","tf.argmax","partMapFlattened","tf.reshape","tf.oneHot","clipByMask2d","image","mask","tf.mul","toMaskTens

```

or", "segmentScores", "threshold", "tf.tidy", "tf.cast", "tf.greater", "tf.scalar", "decodePartSegmentation", "segmentationMask", "_a", "partMapHeight", "partMapWidth", "flattenedMap", "partNumbers", "tf.expandDims", "tf.range", "tf.matmul", "partMap", "partMapShiftedUpForClipping", "tf.add", "tf.sub", "decodeOnlyPartSegmentation", "model", "outputStride", "this", "inputShape", "inputs", "tf.util", "assert", "BaseModel", "input", "asFloat", "_this", "preprocessInput", "asBatch", "results3d", "predict", "map", "y", "tf.squeeze", "namedResults", "nameOutputResults", "heatmapScores", "tf.sigmoid", "heatmap", "offsets", "displacementFwd", "displacementBwd", "segmentation", "partHeatmaps", "longOffsets", "partOffsets", "dispose", "__extends", "MobileNet", "tf.div", "results", "PART_NAMES", "NUM_KEYPOINTS", "length", "PART_IDS", "reduce", "result", "jointName", "i", "CONNECTED_PART_NAMES", "POSE_CHAIN", "CONNECTED_PART_INDICES", "jointNameA", "jointNameB", "getScale", "_b", "padding", "height", "width", "inputResolutionY", "inputResolutionX", "padT", "padB", "getOffsetPoint", "x", "keypoint", "get", "getImageCoords", "part", "heatmapX", "heatmapY", "clamp", "a", "min", "max", "squaredDistance", "y1", "x1", "y2", "x2", "dy", "dx", "addVectors", "b", "computeDistance", "embedding", "pose", "minPartScore", "distance", "numKpt", "p", "keypoints", "score", "Math", "position", "Infinity", "convertToPositionInOutput", "stride", "padL", "scaleX", "scaleY", "round", "getEmbedding", "location", "keypointIndex", "convertToPosition", "outputResolutionX", "refineSteps", "newLocation", "nn", "t", "newPos", "nn_1", "matchEmbeddingToInstance", "poses", "numKptForMatching", "_c", "embed", "pair", "keypointsIndex", "push", "kMin", "kMinDist", "k", "dist", "getOutputResolution", "decodeMultipleMasksCPU", "posesAboveScore", "inHeight", "inWidth", "dataArrays", "Uint8Array", "fill", "j", "n", "decodeMultiplePartMasksCPU", "partSegmentation", "Int32Array", "decodeMultipleMasksWebGL", "minKptScore", "maxNumPeople", "origHeight", "origWidth", "slice", "outHeight", "outWidth", "shapedLongOffsets", "poseVals", "Float32Array", "poseOffset", "kp", "offset", "_d", "posesTensor", "tf.tensor", "program", "variableNames", "outputShape", "userCode", "tf.backend", "compileAndRun", "toPersonKSegmentation", "tf.equal", "toPersonKPartSegmentation", "bodyParts", "isWebGLBackend", "getBackend", "decodePersonInstanceMasks", "minPoseScore", "minKeypointScore", "filter", "personSegmentations", "masksTensorInfo", "masksTensor", "tf.engine", "makeTensorFromDataId", "dataId", "dtype", "_", "Promise", "all", "data", "personSegmentationsData", "forEach", "segmentationsData", "longOffsetsData", "decodePersonInstancePartMasks", "partSegmentation", "partSegmentations", "partSegmentationsByPersonData", "partSegmentationData", "half", "floor", "maxSize", "getElementValue", "priorityQueue", "Array", "numberOfElements", "MaxHeap", "swim", "exchange", "sink", "less", "getValueAt", "scoreIsMaximumInLocalWindow", "keypointId", "localMaximumRadius", "scores", "localMaximum", "yStart", "yEnd", "yCurrent", "xStart", "xEnd", "xCurrent", "buildPartWithScoreQueue", "scoreThreshold", "numKeypoints", "queue", "enqueue", "id", "parentChildrenTuples", "parentJoinName", "childJoinName", "parentToChildEdges", "childToParentEdges", "getDisplacement", "edgeId", "point", "displacements", "numEdges", "getStridedIndexNearPoint", "traverseToTargetKeypoint", "sourceKeypoint", "targetKeypointId", "scoresBuffer", "offsetRefineStep", "displacement", "targetKeypoint", "targetKeypointIndices", "offsetPoint", "targetKeypointIndices", "decodePose", "root", "displacementsFwd", "displacementsBwd", "instanceKeypoints", "rootPart", "rootScore", "rootPoint", "edge", "sourceKeypointId", "withinNmsRadiusOfCorrespondingPoint", "squaredNmsRadius", "some", "correspondingKeypoint", "getInstanceScore", "existingPoses", "kLocalMaximumRadius", "decodeMultiplePoses", "offsetsBuffer", 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pix.js","sources":["../src/decode_part_map.ts","../src/base_model.ts","../src/mobilenet.ts","../src/keypoints.ts","../src/
multi_person/util.ts","../src/multi_person/decode_multiple_masks_cpu.ts","../src/multi_person/decode_multiple_mas
ks_webgl.ts","../src/multi_person/decode_instance_masks.ts","../src/multi_person/max_heap.ts","../src/multi_person
/build_part_with_score_queue.ts","../src/multi_person/decode_pose.ts","../src/multi_person/decode_multiple_poses.t
s","../src/resnet.ts","../src/saved_models.ts","../src/util.ts","../src/body_pix_model.ts","../src/blur.ts","../src/output_re
ndering_util.ts","../src/part_channels.ts","../src/version.ts","../src/index.ts"],"sourcesContent":["/**\n * @license\n *
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=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\n/**\n * Takes the sigmoid of the part heatmap output and
generates a 2d one-hot\n * tensor with ones where the part's score has the maximum value.\n *\n * @param
partHeatmapScores\n *\nfunction toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n
const numParts = partHeatmapScores.shape[2];\n const partMapLocations = tf.argmax(partHeatmapScores, 2);\n
const partMapFlattened = tf.reshape(partMapLocations, [-1]);\n
return tf.oneHot(partMapFlattened, numParts) as tf.Tensor2D;\n}\n\nfunction clipByMask2d(image: tf.Tensor2D,
mask: tf.Tensor2D): tf.Tensor2D {\n return tf.mul(image, mask);\n}\n\n/**\n * Takes the sigmoid of the
segmentation output, and generates a segmentation\n * mask with a 1 or 0 at each pixel where there is a person or
not a person. The\n * segmentation threshold determines the threshold of a score for a pixel for it\n * to be
considered part of a person.\n * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.\n *
@param segmentationThreshold The minimum that segmentation values must have\n * to be considered part of the
person. Affects the generation of the\n * segmentation mask and the clipping of the colored part image.\n *\n *
@return A segmentation mask with a 1 or 0 at each pixel where there is a\n * person or not a person.\n *\nexport
function toMaskTensor(\n segmentScores: tf.Tensor2D, threshold: number): tf.Tensor2D {\n return tf.tidy(\n
() =>\n (tf.cast(tf.greater(\n segmentScores, tf.scalar(threshold)), 'int32') as
tf.Tensor2D));\n}\n\n/**\n * Takes the sigmoid of the person and part map output, and returns a 2d tensor\n * of an
image with the corresponding value at each pixel corresponding to the\n * part with the highest value. These part ids
are clipped by the segmentation\n * mask. Wherever the a pixel is clipped by the segmentation mask, its value\n *
will set to -1, indicating that there is no part in that pixel.\n * @param segmentScores A 3d-tensor of the sigmoid of
the segmentation output.\n * @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap\n * output.
The third dimension corresponds to the part.\n *\n * @returns A 2d tensor of an image with the corresponding value
at each pixel\n * corresponding to the part with the highest value. These part ids are clipped\n * by the segmentation
mask. It will have values of -1 for pixels that are\n * outside of the body
and do not have a corresponding part.\n *\nexport function decodePartSegmentation(\n segmentationMask:
tf.Tensor2D,\n partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n const [partMapHeight, partMapWidth,
numParts] = partHeatmapScores.shape;\n return tf.tidy(() => {\n const flattenedMap =
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toFlattenedOneHotPartMap(partHeatmapScores);\n  const partNumbers = tf.expandDims(tf.range(0, numParts, 1,
'int32'), 1);\n\n  const partMapFlattened =\n    tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D),
'int32');\n\n  const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n\n  const
partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));\n\n  return tf.sub(clipByMask2d(\n
partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask)\n    , tf.scalar(1, 'int32'));\n  });\n\n\nexport
function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D):\n  tf.Tensor2D {\n  const
[partMapHeight, partMapWidth, numParts]
= partHeatmapScores.shape;\n  return tf.tidy(() => {\n    const flattenedMap =
toFlattenedOneHotPartMap(partHeatmapScores);\n    const partNumbers = tf.expandDims(tf.range(0, numParts, 1,
'int32'), 1);\n\n    const partMapFlattened =\n      tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D),
'int32');\n\n    return tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n  });\n}\n\n"/**\n *
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions
and\n * limitations under the License.\n */
=====
*/\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport
{BodyPixOutputStride} from './types';\n\n/**\n * BodyPix supports using various convolution neural network
models\n * (e.g. ResNet and MobileNetV1) as its underlying base model.\n * The following BaseModel interface
defines a unified interface for\n * creating such BodyPix base models. Currently both MobileNet (in\n *
./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel\n * interface. New base models that conform
to the BaseModel interface can be\n * added to BodyPix.\n */\nexport abstract class BaseModel {\n  constructor(\n
protected readonly model: tfconv.GraphModel,\n    public readonly outputStride: BodyPixOutputStride) {\n
const inputShape =\n    this.model.inputs[0].shape as [number, number, number, number];\n
    tf.util.assert(\n      (inputShape[1] === -1) && (inputShape[2] === -1),\n      () => `Input shape
[${inputShape[1]}, ${inputShape[2]}]` +\n        ` must both be equal to or -1`);\n  }\n\n  abstract
preprocessInput(input: tf.Tensor3D): tf.Tensor3D;\n\n  /**\n   * Predicts intermediate Tensor representations.\n   *
@param input The input RGB image of the base model.\n   * A Tensor of shape: [inputResolution`,
inputResolution`, 3].\n   * @return A dictionary of base model's intermediate predictions.\n   * The returned
dictionary should contains the following elements:\n   * - heatmapScores: A Tensor3D that represents the keypoint
heatmap scores.\n   * - offsets: A Tensor3D that represents the offsets.\n   * - displacementFwd: A Tensor3D that
represents the forward displacement.\n   * - displacementBwd: A Tensor3D that represents the backward
displacement.\n   * - segmentation: A Tensor3D that represents the segmentation of all\n   * people.\n   * -
longOffsets:
A Tensor3D that represents the long offsets used for\n   * instance grouping.\n   * - partHeatmaps: A Tensor3D that
represents the body part segmentation.\n   */\n  predict(input: tf.Tensor3D): {\n    heatmapScores: tf.Tensor3D,\n
offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation:
tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets: tf.Tensor3D\n  } {\n
return tf.tidy(() => {\n    const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n    const asBatch =
tf.expandDims(asFloat, 0);\n    const results = this.model.predict(asBatch) as tf.Tensor4D[];\n    const results3d:
tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n    const namedResults =
this.nameOutputResults(results3d);\n    return {\n      heatmapScores: tf.sigmoid(namedResults.heatmap),\n
offsets: namedResults.offsets,\n      displacementFwd: namedResults.displacementFwd,\n
      displacementBwd: namedResults.displacementBwd,\n      segmentation: namedResults.segmentation,\n
      partHeatmaps: namedResults.partHeatmaps,\n      longOffsets: namedResults.longOffsets,\n      partOffsets:

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namedResults.partOffsets\n    });\n    });\n }\n\n // Because MobileNet and ResNet predict() methods output a
different order for\n // these values, we have a method that needs to be implemented to order them.\n abstract
nameOutputResults(results: tf.Tensor3D[]): {\n    heatmap: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation: tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets: tf.Tensor3D\n };\n\n /**\n * Releases
the CPU and GPU memory allocated by the model.\n */\n dispose() {\n    this.model.dispose();\n }\n}\n", "/*\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport { BaseModel } from './base_model';\n\nexport class
MobileNet extends BaseModel {\n    preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n        // Normalize the pixels
[0, 255] to be between [-1, 1].\n        return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n    }\n\n    nameOutputResults(results: tf.Tensor3D[]) {\n        const [\n            offsets,\n            segmentation,\n            partHeatmaps,\n            longOffsets,\n            heatmap,\n            displacementFwd,\n            displacementBwd,\n            partOffsets,\n        ] = results;\n        return {\n            offsets,\n            segmentation,\n            partHeatmaps,\n            longOffsets,\n            heatmap,\n            displacementFwd,\n            displacementBwd,\n            partOffsets\n        };\n    }\n}\n", "/*\n *
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nexport type Tuple<T> = [T, T];\nexport type StringTuple = Tuple<string>;\nexport type NumberTuple =
Tuple<number>;\n\nexport const PART_NAMES = [\n    'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',
'leftShoulder',\n    'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n    'leftHip', 'rightHip', 'leftKnee',
'rightKnee',\n    'leftAnkle', 'rightAnkle'];\n\nexport const NUM_KEYPOINTS = PART_NAMES.length;\n\nexport
interface NumberDict {\n    [jointName: string]: number;\n}\n\nexport const PART_IDS =\nPART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n    result[jointName] = i;\n    return result;\n    }, {});\n\nconst CONNECTED_PART_NAMES: StringTuple[] = [\n    ['leftHip', 'leftShoulder'],\n    ['leftElbow', 'leftShoulder'],\n    ['leftElbow', 'leftWrist'],\n    ['leftHip', 'leftKnee'],\n    ['leftKnee', 'leftAnkle'],\n    ['rightHip', 'rightShoulder'],\n    ['rightElbow', 'rightShoulder'],\n    ['rightElbow', 'rightWrist'],\n    ['rightHip', 'rightKnee'],\n    ['rightKnee', 'rightAnkle'],\n    ['leftShoulder', 'rightShoulder'],\n    ['leftHip', 'rightHip'];\n];\n\n/*\n * Define the skeleton. This defines the parent->child relationships of our\n * tree. Arbitrarily this defines the nose as the root of the tree, however\n * since we will infer the displacement for both parent->child and\n * child->parent, we can define the tree root as any node.\n */\n\nexport const POSE_CHAIN:
StringTuple[] = [\n    ['nose', 'leftEye'],\n    ['leftEye', 'leftEar'],\n    ['nose', 'rightEye'],\n    ['rightEye', 'rightEar'],\n    ['nose', 'leftShoulder'],\n    ['leftShoulder', 'leftElbow'],\n    ['leftElbow', 'leftWrist'],\n    ['leftShoulder', 'leftHip'],\n    ['leftHip', 'leftKnee'],\n    ['leftKnee', 'leftAnkle'],\n    ['nose', 'rightShoulder'],\n    ['rightShoulder', 'rightElbow'],\n    ['rightElbow', 'rightWrist'],\n    ['rightShoulder', 'rightHip'],\n    ['rightHip', 'rightKnee'],\n    ['rightKnee', 'rightAnkle'];\n];\n\nexport const CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(\n    (jointNameA, jointNameB) =>\n        ([PART_IDS[jointNameA], PART_IDS[jointNameB]]);\n);\n", "/*\n *
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*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Part, TensorBuffer3D, Vector2D} from './types';\n\nexport function getScale(\n  height,\n  width: [number, number],\n  [inputResolutionY, inputResolutionX]: [number, number],\n  padding: Padding):\n  [number, number] {\n    const {top: padT, bottom: padB, left: padL, right: padR} = padding;\n    const scaleY = inputResolutionY / (padT + padB + height);\n    const scaleX = inputResolutionX / (padL + padR + width);\n    return [scaleX, scaleY];\n  }\n\nexport function getOffsetPoint(\n  y: number, x: number, keypoint: number, offsets:\n  TensorBuffer3D): Vector2D {\n    return {\n      y: offsets.get(y, x, keypoint),\n      x: offsets.get(y, x, keypoint + NUM_KEYPOINTS)\n    };\n  }\n\nexport function getImageCoords(\n  part: Part, outputStride: number, offsets:\n  TensorBuffer3D): Vector2D {\n    const {heatmapY, heatmapX, id: keypoint} = part;\n    const {y, x} = getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n    return {\n      x: part.heatmapX * outputStride + x,\n      y: part.heatmapY * outputStride + y\n    };\n  }\n\nexport function fillArray<T>(element: T, size: number): T[] {\n  const result:\n  T[] = new Array(size);\n  for (let i = 0; i < size; i++) {\n    result[i] = element;\n  }\n  return result;\n}\n\nexport function clamp(a: number, min: number, max: number): number {\n  if (a < min) {\n    return min;\n  }\n  if (a > max) {\n    return max;\n  }\n  return a;\n}\n\nexport function squaredDistance(\n  y1: number, x1: number, y2:\n  number, x2: number): number {\n  const dy = y2 - y1;\n  const dx = x2 - x1;\n  return dy * dy + dx * dx;\n}\n\nexport function addVectors(a: Vector2D, b: Vector2D): Vector2D {\n  return {x: a.x + b.x, y: a.y + b.y};\n}\n\nexport function clampVector(a: Vector2D, min: number, max: number): Vector2D {\n  return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose} from './types';\nimport {getScale} from './util';\n\ninterface Pair {\n  x: number;\n  y: number;\n}\n\nfunction computeDistance(embedding:\n  Pair[], pose: Pose, minPartScore = 0.3) {\n  let distance = 0.0;\n  let numKpt = 0;\n  for (let p = 0; p < embedding.length; p++) {\n    if (pose.keypoints[p].score > minPartScore) {\n      numKpt += 1;\n      distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n        (embedding[p].y - pose.keypoints[p].position.y) ** 2;\n    }\n  }\n  if (numKpt === 0) {\n    distance = Infinity;\n  } else {\n    distance = distance / numKpt;\n  }\n  return distance;\n}\n\nfunction convertToPositionInOutput(\n  position: Pair, [padT, padL]: [number, number],\n  [scaleX, scaleY]: [number, number], stride: number): Pair {\n  const y = Math.round(((padT + position.y + 1.0) * scaleY - 1.0) / stride);\n  const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n  return {x, y};\n}\n\nfunction getEmbedding(\n  location: Pair, keypointIndex: number,\n  convertToPosition: (pair: Pair) => Pair, outputResolutionX: number,\n  longOffsets: Float32Array, refineSteps: number,\n  [height, width]: [number, number]): Pair {\n  const newLocation = convertToPosition(location);\n  const nn = newLocation.y * outputResolutionX + newLocation.x;\n  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n  let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n  let y = location.y + dy;\n
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    let x = location.x + dx;\n    for (let t = 0; t < refineSteps; t++) {\n      y = Math.min(y, height - 1);\n      x = Math.min(x,\n      width - 1);\n      const newPos = convertToPosition({x, y});\n      const nn = newPos.y * outputResolutionX +\n      newPos.x;\n      dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n      dx =\n      longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n      y = y + dy;\n      x = x + dx;\n    }\n    return {x,\n    y};\n  }\n  function matchEmbeddingToInstance(\n    location: Pair, longOffsets: Float32Array, poses: Pose[],\n    numKptForMatching: number, [padT, padL]: [number, number],\n    [scaleX, scaleY]: [number, number],\n    outputResolutionX: number,\n    [height, width]: [number, number], stride: number,\n    refineSteps: number):\n    number {\n      const embed: Pair[] = [];\n      const convertToPosition = (pair: Pair) =>\n      convertToPositionInOuput(pair, [padT, padL], [scaleX, scaleY], stride);\n      for (let keypointsIndex = 0;\n      keypointsIndex < numKptForMatching;\n      keypointsIndex++)\n        {\n          const embedding = getEmbedding(\n            location, keypointsIndex, convertToPosition, outputResolutionX,\n            longOffsets, refineSteps, [height, width]);\n          embed.push(embedding);\n        }\n        let kMin = -1;\n        let kMinDist = Infinity;\n        for (let k = 0; k < poses.length; k++) {\n          const dist = computeDistance(embed, poses[k]);\n          if (dist < kMinDist) {\n            kMin = k;\n            kMinDist = dist;\n          }\n        }\n        return kMin;\n      }\n      function\n      getOutputResolution(\n        [inputResolutionY, inputResolutionX]: [number, number],\n        stride: number): [number,\n        number] {\n          const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);\n          const\n          outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);\n          return [outputResolutionX,\n          outputResolutionY];\n        }\n        export function decodeMultipleMasksCPU(\n          segmentation: Uint8Array, longOffsets:\n          Float32Array,\n          posesAboveScore: Pose[], height: number, width: number, stride: number,\n          [inHeight,\n          inWidth]: [number, number], padding: Padding,\n          refineSteps: number, numKptForMatching = 5): Uint8Array[]\n          {\n            const dataArrays =\n            posesAboveScore.map(x => new Uint8Array(height * width).fill(0));\n            const {top:\n            padT, left: padL} = padding;\n            const [scaleX, scaleY] =\n            getScale([height, width], [inHeight, inWidth],\n            padding);\n            const [outputResolutionX, ] =\n            getOutputResolution([inHeight, inWidth], stride);\n            for (let i = 0; i < height;\n            i += 1) {\n              for (let j = 0; j < width;\n              j += 1) {\n                const n = i * width + j;\n                const prob =\n                segmentation[n];\n                if (prob === 1) {\n                  const kMin = matchEmbeddingToInstance(\n                    {x: j, y: i},\n                    longOffsets, posesAboveScore, numKptForMatching,\n                    [padT, padL], [scaleX, scaleY], outputResolutionX,\n                    [height, width],\n                    stride, refineSteps);\n                  if (kMin >= 0) {\n                    dataArrays[kMin][n] = 1;\n                  }\n                }\n              }\n            }\n            return dataArrays;\n          }\n          export function decodeMultiplePartMasksCPU(\n            segmentation: Uint8Array, longOffsets: Float32Array,\n            partSegmentaion: Uint8Array, posesAboveScore:\n            Pose[], height: number,\n            width: number, stride: number, [inHeight, inWidth]: [number, number],\n            padding:\n            Padding, refineSteps: number,\n            numKptForMatching = 5): Int32Array[] {\n              const dataArrays =\n              posesAboveScore.map(x => new Int32Array(height * width).fill(-1));\n              const {top: padT, left: padL} =\n              padding;\n              const [scaleX, scaleY] =\n              getScale([height, width], [inHeight, inWidth], padding);\n              const\n              [outputResolutionX, ] =\n              getOutputResolution([inHeight, inWidth], stride);\n              for (let i = 0; i < height;\n              i += 1)\n                {\n                  for (let j = 0; j < width;\n                  j += 1) {\n                    const n = i * width + j;\n                    const prob = segmentation[n];\n                    if (prob\n                    === 1) {\n                      const kMin = matchEmbeddingToInstance(\n                        {x: j, y: i}, longOffsets, posesAboveScore,\n                        numKptForMatching,\n                        [padT, padL], [scaleX, scaleY], outputResolutionX,\n                        [height, width],\n                        stride, refineSteps);\n                      if (kMin >= 0) {\n                        dataArrays[kMin][n] =\n                        partSegmentaion[n];\n                      }\n                    }\n                  }\n                }\n              }\n              return dataArrays;\n            }\n            "\n    /*\n    * @license\n    * Copyright 2019\n    * Google Inc. All Rights Reserved.\n    * Licensed under the Apache License, Version 2.0 (the \"License\");\n    * you\n    * may not use this file except in compliance with the License.\n    * You may obtain a copy of the License at\n    * http://www.apache.org/licenses/LICENSE-2.0\n    * Unless required by applicable law or agreed to in writing,\n    * software\n    * distributed under the License is distributed on an \"AS IS\" BASIS,\n    * WITHOUT WARRANTIES\n    * OR CONDITIONS OF ANY KIND, either express or implied.\n    * See the License for the specific language\n    * governing permissions and\n    * limitations under the License.\n    *\n    *\n    *\n    */

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*\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from

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'@tensorflow/tfjs-backend-webgl';\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose}
from './types';\nimport {getScale} from './util';\n\nexport function decodeMultipleMasksWebGL(\n  segmentation:
tf.Tensor2D, longOffsets: tf.Tensor3D,\n  posesAboveScore: Pose[], height: number, width: number, stride:
number,\n  [inHeight, inWidth]: [number, number], padding: Padding,\n  refineSteps: number, minKptScore:
number,\n  maxNumPeople: number): tf.TensorInfo {\n  // The height/width of the image/canvas itself.\n  const
[origHeight, origWidth] = segmentation.shape;\n  // The height/width of the output of the model.\n  const
[outHeight, outWidth] = longOffsets.shape.slice(0, 2);\n\n  const shapedLongOffsets: tf.Tensor4D =\n  tf.reshape(longOffsets, [outHeight, outWidth, 2, NUM_KEYPOINTS]);\n\n  // Make pose tensor of shape
[MAX_NUM_PEOPLE, NUM_KEYPOINTS, 3] where\n  // the last 3 coordinates correspond to the score, h and w
coordinate of that\n  // keypoint.\n\n  const poseVals = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n  for (let i = 0; i <
posesAboveScore.length; i++) {\n    const poseOffset = i * NUM_KEYPOINTS * 3;\n    const pose =
posesAboveScore[i];\n    for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n      const keypoint =
pose.keypoints[kp];\n      const offset = poseOffset + kp * 3;\n      poseVals[offset] = keypoint.score;\n      poseVals[offset + 1] = keypoint.position.y;\n      poseVals[offset + 2] = keypoint.position.x;\n    }\n  }\n\n  const
[scaleX, scaleY] =\n    getScale([height, width], [inHeight, inWidth], padding);\n\n  const posesTensor =
tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n\n  const {top: padT, left: padL} = padding;\n\n  const program: tf_webgl.GPGPUProgram = {\n    variableNames: ['segmentation', 'longOffsets', 'poses'],\n    outputShape: [origHeight, origWidth],\n    userCode: `\n    int convertToPositionInOutput(int pos, int pad, float
scale, int stride) {\n      return round(((float(pos
+ pad) + 1.0) * scale - 1.0) / float(stride));\n    }\n\n    float convertToPositionInOutputFloat(\n      int pos, int pad,
float scale, int stride) {\n      return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);\n    }\n\n    float dist(float
x1, float y1, float x2, float y2) {\n      return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);\n    }\n\n    float
sampleLongOffsets(float h, float w, int d, int k) {\n      float fh = fract(h);\n      float fw = fract(w);\n      int clH =
int(ceil(h));\n      int clW = int(ceil(w));\n      int flH = int(floor(h));\n      int flW = int(floor(w));\n      float o11 =
getLongOffsets(flH, flW, d, k);\n      float o12 = getLongOffsets(flH, clW, d, k);\n      float o21 =
getLongOffsets(clH, flW, d, k);\n      float o22 = getLongOffsets(clH, clW, d, k);\n      float o1 = mix(o11, o12,
fw);\n      float o2 = mix(o21, o22, fw);\n      return mix(o1, o2, fh);\n    }\n\n    int findNearestPose(int h, int w) {\n
float prob = getSegmentation(h,
w);\n    if (prob < 1.0) {\n      return -1;\n    }\n\n    // Done(Tyler): convert from output space h/w to strided
space.\n    float stridedH = convertToPositionInOutputFloat(\n      h, ${padT}, ${scaleY}, ${stride});\n    float
stridedW = convertToPositionInOutputFloat(\n      w, ${padL}, ${scaleX}, ${stride});\n\n    float minDist =
1000000.0;\n    int iMin = -1;\n    for (int i = 0; i < ${maxNumPeople}; i++) {\n      float curDistSum = 0.0;\n      int numKpt = 0;\n      for (int k = 0; k < ${NUM_KEYPOINTS}; k++) {\n        float dy =
sampleLongOffsets(stridedH, stridedW, 0, k);\n        float dx = sampleLongOffsets(stridedH, stridedW, 1, k);\n\n        float y = float(h) + dy;\n        float x = float(w) + dx;\n\n        for (int s = 0; s < ${refineSteps}; s++) {\n          int yRounded = round(min(y, float(${height} - 1.0)));\n          int xRounded = round(min(x, float(${width} - 1.0)));\n          float yStrided = convertToPositionInOutputFloat(\n            yRounded, ${padT}, ${scaleY}, ${stride});\n          float xStrided = convertToPositionInOutputFloat(\n            xRounded, ${padL}, ${scaleX}, ${stride});\n\n          float dy = sampleLongOffsets(yStrided, xStrided, 0,
k);\n          float dx = sampleLongOffsets(yStrided, xStrided, 1, k);\n\n          y = y + dy;\n          x = x + dx;\n        }\n\n        float poseScore = getPoses(i, k, 0);\n        float poseY = getPoses(i, k, 1);\n        float poseX =
getPoses(i, k, 2);\n        if (poseScore > ${minKptScore}) {\n          numKpt = numKpt + 1;\n          curDistSum =
curDistSum + dist(x, y, poseX, poseY);\n        }\n      }\n      if (numKpt > 0 && curDistSum / float(numKpt) <
minDist) {\n        minDist = curDistSum / float(numKpt);\n        iMin = i;\n      }\n    }\n    return iMin;\n  }\n\n  void main() {\n    ivec2 coords = getOutputCoords();\n    int nearestPose = findNearestPose(coords[0],
coords[1]);\n    setOutput(float(nearestPose));\n  }\n  }\n\n  const webglBackend = tf.backend() as
tf_webgl.MathBackendWebGL;\n  return webglBackend.compileAndRun(\n    program, [segmentation,

```

shapedLongOffsets, posesTensor]);\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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```

=====
*\n\nimport * as tf
  from '@tensorflow/tfjs-core';\nimport {getBackend} from '@tensorflow/tfjs-core';\nimport {Padding,
PartSegmentation, PersonSegmentation, Pose} from './types';\nimport {decodeMultipleMasksCPU,
decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';\nimport {decodeMultipleMasksWebGl} from
 './decode_multiple_masks_webgl';\n\nexport function toPersonKSegmentation(\n  segmentation: tf.Tensor2D, k:
number): tf.Tensor2D {\n  return tf.tidy(\n    () => (tf.cast(tf.equal(\n      segmentation, tf.scalar(k)), 'int32') as
tf.Tensor2D));\n}\n\nexport function toPersonKPartSegmentation(\n  segmentation: tf.Tensor2D, bodyParts:
tf.Tensor2D, k: number): tf.Tensor2D {\n  return tf.tidy(\n    () => tf.sub(tf.mul(tf.cast(tf.equal(\n
segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));\n}\n\nfunction isWebGLBackend() {\n  return
getBackend() === 'webgl';\n}\n\nexport async function decodePersonInstanceMasks(\n  segmentation:
tf.Tensor2D, longOffsets: tf.Tensor3D,
  poses: Pose[],\n  height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number],
padding: Padding, minPoseScore = 0.2,\n  refineSteps = 8, minKeypointScore = 0.3,\n  maxNumPeople = 10):
Promise<PersonSegmentation[]> {\n  // Filter out poses with smaller score.\n  const posesAboveScore =
poses.filter(pose => pose.score >= minPoseScore);\n  let personSegmentationsData: Uint8Array[];\n  if
(isWebGLBackend()) {\n    const personSegmentations = tf.tidy(() => {\n      const masksTensorInfo =
decodeMultipleMasksWebGl(\n        segmentation, longOffsets, posesAboveScore, height, width, stride,\n
[inHeight, inWidth], padding, refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n
masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map(\n        (_, k) =>
toPersonKSegmentation(masksTensor,
k));\n    });\n    personSegmentationsData =\n      (await Promise.all(personSegmentations.map(mask =>
mask.data()))) as\n      Uint8Array[];\n    personSegmentations.forEach(x => x.dispose());\n  } else {\n    const
segmentationsData = await segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data()
as Float32Array;\n    personSegmentationsData = decodeMultipleMasksCPU(\n      segmentationsData,
longOffsetsData, posesAboveScore, height, width,\n      stride, [inHeight, inWidth], padding, refineSteps);\n  }\n  return personSegmentationsData.map(\n    (data, i) => ({data, pose: posesAboveScore[i], width,
height}));\n}\n\nexport async function decodePersonInstancePartMasks(\n  segmentation: tf.Tensor2D,
longOffsets: tf.Tensor3D,\n  partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n
stride: number, [inHeight, inWidth]: [number, number], padding: Padding,\n  minPoseScore = 0.2, refineSteps = 8,
minKeypointScore
= 0.3,\n  maxNumPeople = 10): Promise<PartSegmentation[]> {\n  const posesAboveScore = poses.filter(pose =>
pose.score >= minPoseScore);\n  let partSegmentationsByPersonData: Int32Array[];\n  if (isWebGLBackend())
{\n    const partSegmentations = tf.tidy(() => {\n      const masksTensorInfo = decodeMultipleMasksWebGl(\n
segmentation, longOffsets, posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding,
refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n
masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map(\n        (_, k) =>{\n
toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n    });\n    partSegmentationsByPersonData =\n      (await Promise.all(partSegmentations.map(x => x.data()))) as\n      Int32Array[];\n  }\n}

```

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partSegmentations.forEach(x => x.dispose());\n
  } else {\n  const segmentationsData = await segmentation.data() as Uint8Array;\n  const longOffsetsData =
await longOffsets.data() as Float32Array;\n  const partSegmentaionData = await partSegmentation.data() as
Uint8Array;\n\n  partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n  segmentationsData,
longOffsetsData, partSegmentaionData,\n  posesAboveScore, height, width, stride, [inHeight, inWidth],
padding,\n  refineSteps);\n  }\n\n  return partSegmentationsByPersonData.map(\n  (data, k) => ({pose:
posesAboveScore[k], data, height, width}));\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\n\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n//
https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n\nfunction half(k: number) {\n return
Math.floor(k / 2);\n}\n\nexport class MaxHeap<T> {\n private priorityQueue: T[];\n private numberOfElements:
number;\n private getElementValue: (element: T) => number;\n\n constructor(maxSize: number, getElementValue:
(element: T) => number) {\n this.priorityQueue = new Array(maxSize);\n this.numberOfElements = -1;\n
this.getElementValue = getElementValue;\n }\n\n public enqueue(x: T): void {\n
this.priorityQueue[++this.numberOfElements] = x;\n this.swim(this.numberOfElements);\n
}\n\n public dequeue(): T {\n const max = this.priorityQueue[0];\n this.exchange(0, this.numberOfElements--
);\n this.sink(0);\n this.priorityQueue[this.numberOfElements + 1] = null;\n return max;\n }\n\n public
empty(): boolean {\n return this.numberOfElements === -1;\n }\n\n public size(): number {\n return
this.numberOfElements + 1;\n }\n\n public all(): T[] {\n return this.priorityQueue.slice(0, this.numberOfElements
+ 1);\n }\n\n public max(): T {\n return this.priorityQueue[0];\n }\n\n private swim(k: number): void {\n while
(k > 0 && this.less(half(k), k)) {\n this.exchange(k, half(k));\n k = half(k);\n }\n }\n\n private sink(k:
number): void {\n while (2 * k <= this.numberOfElements) {\n let j = 2 * k;\n if (j < this.numberOfElements
&& this.less(j, j + 1)) {\n j++;\n }\n if (!this.less(k, j)) {\n break;\n }\n this.exchange(k, j);\n
k = j;\n }\n }\n\n private
getValueAt(i: number): number {\n return this.getElementValue(this.priorityQueue[i]);\n }\n\n private less(i:
number, j: number): boolean {\n return this.getValueAt(i) < this.getValueAt(j);\n }\n\n private exchange(i:
number, j: number): void {\n const t = this.priorityQueue[i];\n this.priorityQueue[i] = this.priorityQueue[j];\n
this.priorityQueue[j] = t;\n }\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====\n
*\n\nimport {PartWithScore, TensorBuffer3D} from './types';\n\nimport {MaxHeap} from
'./max_heap';\n\nfunction scoreIsMaximumInLocalWindow(\n  keypointId: number, score: number, heatmapY:
number, heatmapX: number,\n  localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n const
[height, width] = scores.shape;\n\n let localMaximum = true;\n const yStart = Math.max(heatmapY -
localMaximumRadius, 0);\n const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n for (let

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yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n  const xStart = Math.max(heatmapX - localMaximumRadius,
0);\n  const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n  for (let xCurrent = xStart;
xCurrent < xEnd; ++xCurrent) {\n    if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n      localMaximum
= false;\n      break;\n    }\n  }\n  if (!localMaximum)
{\n    break;\n  }\n }\n return localMaximum;\n}\n\n/*\n * Builds a priority queue with part candidate
positions for a specific image in\n * the batch. For this we find all local maxima in the score maps with score\n *
values above a threshold. We create a single priority queue across all parts.\n */\nexport function
buildPartWithScoreQueue(\n  scoreThreshold: number, localMaximumRadius: number,\n  scores:
TensorBuffer3D): MaxHeap<PartWithScore> {\n  const [height, width, numKeypoints] = scores.shape;\n\n  const
queue = new MaxHeap<PartWithScore>(\n    height * width * numKeypoints, ({score}) => score);\n\n  for (let
heatmapY = 0; heatmapY < height; ++heatmapY) {\n    for (let heatmapX = 0; heatmapX < width; ++heatmapX) {\n
      for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {\n        const score = scores.get(heatmapY,
heatmapX, keypointId);\n\n        // Only consider parts with score greater or equal to threshold as\n        // root
candidates.\n\n        if (score < scoreThreshold) {\n          continue;\n        }\n\n        // Only consider keypoints whose score is
maximum in a local window.\n        if (scoreIsMaximumInLocalWindow(\n          keypointId, score, heatmapY,
heatmapX, localMaximumRadius,\n          scores)) {\n          queue.enqueue({score, part: {heatmapY, heatmapX,
id: keypointId}});\n        }\n      }\n    }\n  }\n  return queue;\n}\n\n"}\n\n/*\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n
*/\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';\nimport {Keypoint,
PartWithScore, TensorBuffer3D, Vector2D} from './types';\nimport {clamp, getOffsetPoint} from './util';\nimport
{addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n  ([parentJoinName, childJoinName]): NumberTuple =>\n  ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\nparentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\nparentChildrenTuples.map(([\n  parentJointId,\n  ] =>
parentJointId);\n\nfunction getDisplacement(\n  edgeId: number, point: Vector2D, displacements:
TensorBuffer3D): Vector2D {\n  const
numEdges = displacements.shape[2] / 2;\n  return {\n    y: displacements.get(point.y, point.x, edgeId),\n    x:
displacements.get(point.y, point.x, numEdges + edgeId)\n  };}\n\nfunction getStridedIndexNearPoint(\n  point:
Vector2D, outputStride: number, height: number,\n  width: number): Vector2D {\n  return {\n    y:
clamp(Math.round(point.y / outputStride), 0, height - 1),\n    x: clamp(Math.round(point.x / outputStride), 0, width -
1)\n  };\n}\n\n/*\n * We get a new keypoint along the `edgeId` for the pose instance, assuming\n * that the position
of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target
part (stored in\n * the `i-t` channel of the displacement tensor). The displaced keypoint\n * vector is refined using
the offset vector by `offsetRefineStep` times.\n */\nfunction traverseToTargetKeypoint(\n  edgeId: number,
sourceKeypoint: Keypoint, targetKeypointId: number,\n  scoresBuffer: TensorBuffer3D, offsets:
TensorBuffer3D, outputStride: number,\n  displacements: TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n  const [height, width] = scoresBuffer.shape;\n\n  // Nearest neighbor interpolation for the source->target
displacements.\n  const sourceKeypointIndices = getStridedIndexNearPoint(\n    sourceKeypoint.position,
outputStride, height, width);\n\n  const displacement =\n    getDisplacement(edgeId, sourceKeypointIndices,
displacements);\n\n  const displacedPoint = addVectors(sourceKeypoint.position, displacement);\n  let

```



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}, 0.0);
return notOverlappedKeypointScores /= instanceKeypoints.length;
}
// A point (y, x) is considered
as root part candidate if its score is a
// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <=
// kLocalMaximumRadius.
const kLocalMaximumRadius = 1;
// Detects multiple poses and finds their parts
from part scores and
// displacement vectors. It returns up to `maxDetections` object instance
// detections in
decreasing root score order. It works as follows: We first
// create
a priority queue with local part score maxima above
// `scoreThreshold`, considering all parts at the same time.
Then we
// iteratively pull the top element of the queue (in decreasing score order)
// and treat it as a root
candidate for a new object instance. To avoid
// duplicate detections, we reject the root candidate if it is within a
// disk
// of `nmsRadius` pixels from the corresponding part of a previously detected
// instance, which is a form of
part-based non-maximum suppression (NMS). If
// the root candidate passes the NMS check, we start a new object
instance
// detection, treating the corresponding part as root and finding the
// positions of the remaining parts by
following the displacement vectors
// along the tree-structured part graph. We assign to the newly detected
// instance a score equal to the sum of scores of its parts which have not
// been claimed by a previous instance (i.e.,
those at least `nmsRadius`
// pixels away from the corresponding part
of all previously detected
// instances), divided by the total number of parts `numParts`.
// @param
heatmapScores 3-D tensor with shape `[height, width, numParts]`.
// The value of heatmapScores[y, x, k] is the
score of placing the `k`-th
// object part at position `(y, x)`.
// @param offsets 3-D tensor with shape `[height,
width, numParts * 2]`.
// The value of [offsets[y, x, k], offsets[y, x, k + numParts]] is the
// short range offset
vector of the `k`-th
// object part at heatmap
// position `(y, x)`.
// @param displacementsFwd 3-D tensor of
shape
// `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is the
// number of edges (parent-child pairs) in the tree. It contains the forward
// displacements between consecutive part from the root towards the
leaves.
// @param displacementsBwd 3-D tensor of shape
// `[height, width, 2 * num_edges]`, where
`num_edges = num_parts - 1` is the
// number of edges (parent-child pairs) in the tree.
It contains the backward
// displacements between consecutive part from the root towards the leaves.
// @param outputStride The output stride that was used when feed-forwarding
// through the PoseNet model. Must
be 32, 16, or 8.
// @param maxPoseDetections Maximum number of returned instance detections per
// image.
// @param scoreThreshold Only return instance detections that have root part
// score greater or equal
to this value. Defaults to 0.5.
// @param nmsRadius Non-maximum suppression part distance. It needs to be
// strictly positive. Two parts suppress each other if they are less than
// `nmsRadius` pixels away. Defaults to 20.
// @return An array of poses and their scores, each containing keypoints and
// the corresponding keypoint
scores.
// @export function decodeMultiplePoses(scoresBuffer: TensorBuffer3D, offsetsBuffer:
TensorBuffer3D,
// displacementsFwdBuffer: TensorBuffer3D, displacementsBwdBuffer: TensorBuffer3D,
outputStride:
number,
// maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {
const poses: Pose[] =
[];
const queue = buildPartWithScoreQueue(
// scoreThreshold, kLocalMaximumRadius, scoresBuffer);
const squaredNmsRadius = nmsRadius * nmsRadius;
// Generate at most maxDetections object instances per
image in
// decreasing root part score order.
while (poses.length < maxPoseDetections && !queue.empty()) {
// The top element in the queue is the next root candidate.
const root = queue.dequeue();
// Part-based non-
maximum suppression: We reject a root candidate if it
// is within a disk of `nmsRadius` pixels from the
corresponding part of
// a previously detected instance.
const rootImageCoords =
getImageCoords(root.part, outputStride, offsetsBuffer);
if (withinNmsRadiusOfCorrespondingPoint(
// poses, squaredNmsRadius, rootImageCoords, root.part.id))
continue;
// Start
a new detection instance at the position of the root.
const keypoints = decodePose(
// root, scoresBuffer,
offsetsBuffer, outputStride, displacementsFwdBuffer,
// displacementsBwdBuffer);
const score =
getInstanceScore(poses, squaredNmsRadius, keypoints);
poses.push({keypoints, score});
}
return
poses;
}
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```
=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {BaseModel} from './base_model';\nconst\nimageNetMean = [-123.15, -115.90, -103.06];\nexport class ResNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    return tf.add(input, imageNetMean);\n  }\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      displacementBwd,\n      displacementFwd,\n      heatmap,\n      longOffsets,\n      offsets,\n      partHeatmaps,\n      segmentation,\n      partOffsets,\n    ] = results;\n    return {\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    };}\n}\n\n"/**\n * @license\n * Copyright 2019\n * Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * https://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nconst RESNET50_BASE_URL =\n  'https://storage.googleapis.com/tfjs-\n  models/savedmodel/bodypix/resnet50';\nconst MOBILENET_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet';\n\n// The BodyPix 2.0 ResNet50\nmodels use the latest TensorFlow.js 1.0 model\n// format.\nexport function resNet50SavedModel(stride: number,\n  quantBytes: number): string {\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding\n  to the\n  non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return RESNET50_BASE_URL + `float^\n  + graphJson`;\n  } else {\n    return RESNET50_BASE_URL + `quant${quantBytes}^\n  + graphJson`;\n  }}\n\n// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function\nmobileNetSavedModel(\n  stride: number, multiplier: number, quantBytes: number): string {\n  const toStr: {[key:\n  number]: string} = {1.0: '100', 0.75: '075', 0.50: '050'};\n  const graphJson = `model-stride${stride}.json`;\n  //\n  quantBytes=4 corresponding to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return\n  MOBILENET_BASE_URL + `float${toStr[multiplier]}^\n  + graphJson`;\n  } else {\n    return\n  MOBILENET_BASE_URL + `quant${quantBytes}/${toStr[multiplier]}^\n  +\n  graphJson`;\n  }}\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0\n * (the \"License\");\n * you may\n * not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n
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=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {BodyPixInput, BodyPixOutputStride, Padding} from\n './types';\nimport {Pose, TensorBuffer3D} from './types';\nimport {BodyPixInternalResolution} from\n './types';\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\n  HTMLCanvasElement|\n  OffscreenCanvas): [number, number] {\n  if ('offsetHeight'\n  in input && input.offsetHeight !== 0\n  && 'offsetWidth' in input && input.offsetWidth !== 0) {\n    return\n  [input.offsetHeight, input.offsetWidth];\n  } else if (input.height != null && input.width != null) {\n    return\n  [input.height, input.width];\n  } else {\n    throw new Error(\n  `HTMLImageElement must have height and\n  width attributes set.`);\n  }}\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,\n
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number] {\n if (input.hasAttribute('height') && input.hasAttribute('width')) {\n // Prioritizes user specified height
and width.\n // We can't test the .height and .width properties directly,\n // because they evaluate to 0 if unset.\n
return [input.height, input.width];\n } else {\n return [input.videoHeight, input.videoWidth];\n }\n}\n\nexport
function getInputSize(input: BodyPixInput): [number, number] {\n if ((typeof (HTMLCanvasElement) !==
'undefined' &&\n input instanceof HTMLCanvasElement) ||\n (typeof
(OffscreenCanvas) !== 'undefined' &&\n input instanceof OffscreenCanvas) ||\n (typeof
(HTMLImageElement) !== 'undefined' &&\n input instanceof HTMLImageElement)) {\n return
getSizeFromImageLikeElement(input);\n } else if (typeof (ImageData) !== 'undefined' && input instanceof
ImageData) {\n return [input.height, input.width];\n } else if (\n typeof (HTMLVideoElement) !== 'undefined'
&&\n input instanceof HTMLVideoElement) {\n return getSizeFromVideoElement(input);\n } else if (input
instanceof tf.Tensor) {\n return [input.shape[0], input.shape[1]];\n } else {\n throw new Error('error: Unknown
input type: ${input}.');\n }\n}\n\nfunction isValidInputResolution(\n resolution: number, outputStride: number):
boolean {\n return (resolution - 1) % outputStride === 0;\n}\n\nexport function toValidInputResolution(\n
inputResolution: number, outputStride: BodyPixOutputStride): number {\n if
(isValidInputResolution(inputResolution, outputStride))
{\n return inputResolution;\n }\n\n return Math.floor(inputResolution / outputStride) * outputStride +
1;\n}\n\nconst INTERNAL_RESOLUTION_STRING_OPTIONS = {\n low: 'low',\n medium: 'medium',\n high:
'high',\n full: 'full'\n};\n\nconst INTERNAL_RESOLUTION_PERCENTAGES = {\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst MIN_INTERNAL_RESOLUTION =
0.1;\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n
internalResolution: BodyPixInternalResolution): number {\n if (typeof internalResolution === 'string') {\n const
result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n\n tf.util.assert(\n typeof result
=== 'number',\n () => `string value of inputResolution must be one of ${\n
Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n
.join(',')}` but was ${internalResolution}.');\n return result;\n } else {\n tf.util.assert(\n typeof
internalResolution === 'number' &&\n internalResolution <= MAX_INTERNAL_RESOLUTION &&\n
internalResolution >= MIN_INTERNAL_RESOLUTION,\n () =>\n `inputResolution must be a string
or number between ${\n MIN_INTERNAL_RESOLUTION} and ${MAX_INTERNAL_RESOLUTION},\n
but ` +\n `was ${internalResolution}`);\n\n return internalResolution;\n }\n}\n\nexport function
toInputResolutionHeightAndWidth(\n internalResolution: BodyPixInternalResolution,\n outputStride:
BodyPixOutputStride,\n [inputHeight, inputWidth]: [number, number]): [number, number] {\n const
internalResolutionPercentage =\n toInternalResolutionPercentage(internalResolution);\n\n return [\n
toValidInputResolution(\n inputHeight * internalResolutionPercentage, outputStride),\n
toValidInputResolution(\n inputWidth
* internalResolutionPercentage, outputStride)\n ];\n}\n\nexport function toInputTensor(input: BodyPixInput) {\n //
TODO: tf.browser.fromPixels types to support OffscreenCanvas\n // @ts-ignore\n return input instanceof tf.Tensor
? input : tf.browser.fromPixels(input);\n}\n\nexport function resizeAndPadTo(\n imageTensor: tf.Tensor3D,
[targetH, targetW]: [number, number],\n flipHorizontal = false): {\n resizedAndPadded: tf.Tensor3D,\n
paddedBy: [[number, number], [number, number]]\n } {\n const [height, width] = imageTensor.shape;\n\n const
targetAspect = targetW / targetH;\n const aspect = width / height;\n\n let resizeW: number;\n let resizeH:
number;\n let padL: number;\n let padR: number;\n let padT: number;\n let padB: number;\n\n if (aspect >
targetAspect) {\n // resize to have the larger dimension match the shape.\n resizeW = targetW;\n resizeH =
Math.ceil(resizeW / aspect);\n\n const padHeight = targetH - resizeH;\n padL = 0;\n padR = 0;\n
padT = Math.floor(padHeight / 2);\n padB = targetH - (resizeH + padT);\n } else {\n resizeH = targetH;\n
resizeW = Math.ceil(targetH * aspect);\n\n const padWidth = targetW - resizeW;\n padL = Math.floor(padWidth

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/ 2);\n  padR = targetW - (resizeW + padL);\n  padT = 0;\n  padB = 0;\n  }\n\n  const resizedAndPadded =
tf.tidy(() => {\n  // resize to have largest dimension match image\n  let resized: tf.Tensor3D;\n  if
(flipHorizontal) {\n    resized = tf.image.resizeBilinear(\n      tf.reverse(imageTensor, 1), [resizeH, resizeW]);\n
  } else {\n    resized = tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n  }\n\n  const padded =
tf.pad3d(resized, [[padT, padB], [padL, padR], [0, 0]]);\n\n  return padded;\n  });\n\n  return {resizedAndPadded,
paddedBy: [[padT, padB], [padL, padR]]};\n}\n\nexport function scaleAndCropToInputTensorShape(\n  tensor:
tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number, number],\n  [resizedAndPaddedHeight,
resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number, number], [number,
number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return tf.tidy(() => {\n    let inResizedAndPadded:
tf.Tensor3D = tf.image.resizeBilinear(tensor,\n      [resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n
    if (applySigmoidActivation) {\n      inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n    }\n\n    return
removePaddingAndResizeBack(\n      inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n
[[padT, padB], [padL, padR]]);\n  });\n}\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded:
tf.Tensor3D,\n  [originalHeight, originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number,
number], [number, number]]):\n  tf.Tensor3D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =
tf.expandDims(resizedAndPadded);\n    return tf.squeeze(tf.image\n      .cropAndResize(\n
        batchedImage, [[\n          padT / (originalHeight + padT + padB - 1.0),\n          padL / (originalWidth +
padL + padR - 1.0),\n          (padT + originalHeight - 1.0) ^\n          (originalHeight + padT + padB - 1.0),\n
          (padL + originalWidth - 1.0) / (originalWidth + padL + padR - 1.0)\n        ]],\n        [0], [originalHeight,
originalWidth]), [0]);\n  });\n}\n\nexport function resize2d(\n  tensor: tf.Tensor2D, resolution: [number, number],\n
nearestNeighbor?: boolean): tf.Tensor2D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =
tf.expandDims(tensor, 2);\n    return tf.squeeze(\n      tf.image.resizeBilinear(batchedImage, resolution,
nearestNeighbor));\n  });\n}\n\nexport function padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]:
[number, number]):\n  {resized: tf.Tensor3D, padding: Padding} {\n  const [height, width] = getInputSize(input);\n
const targetAspect = targetW / targetH;\n
  const aspect = width / height;\n  let [padT, padB, padL, padR] = [0, 0, 0, 0];\n  if (aspect < targetAspect) {\n  //
pads the width\n  padT = 0;\n  padB = 0;\n  padL = Math.round(0.5 * (targetAspect * height - width));\n  padR
= Math.round(0.5 * (targetAspect * height - width));\n  } else {\n  // pads the height\n  padT = Math.round(0.5 *
((1.0 / targetAspect) * width - height));\n  padB = Math.round(0.5 * ((1.0 / targetAspect) * width - height));\n
padL = 0;\n  padR = 0;\n  }\n\n  const resized: tf.Tensor3D = tf.tidy(() => {\n    let imageTensor =
toInputTensor(input);\n    imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);\n\n    return
tf.image.resizeBilinear(imageTensor, [targetH, targetW]);\n  });\n\n  return {resized, padding: {top: padT, left: padL,
right: padR, bottom: padB}};\n}\n\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\n  Promise<TensorBuffer3D[]> {\n  return Promise.all(tensors.map(tensor => tensor.buffer()));\n}\n\nexport
function scalePose(\n  pose: Pose, scaleY: number, scaleX: number, offsetY = 0,\n  offsetX = 0): Pose {\n  return
{\n    score: pose.score,\n    keypoints: pose.keypoints.map(({score, part, position}) => ({\n
      score,\n      part,\n      position: {\n        x: position.x *
scaleX + offsetX,\n        y: position.y * scaleY + offsetY\n      }\n    })))\n  };\n}\n\nexport function scalePoses(\n  poses: Pose[], scaleY: number, scaleX: number, offsetY = 0,
offsetX = 0) {\n  if (scaleX === 1 && scaleY === 1 && offsetY === 0 && offsetX === 0) {\n    return poses;\n
  }\n  return poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));\n}\n\nexport function
flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {\n  return {\n    score: pose.score,\n
    keypoints: pose.keypoints.map(\n      ({score, part, position}) => ({\n        score,\n        part,\n        position:
{x: imageWidth - 1 - position.x, y: position.y\n      })\n    }));\n  }\n}\n\nexport function flipPosesHorizontal(poses:
Pose[], imageWidth: number) {\n  if (imageWidth <= 0) {\n    return poses;\n  }\n  return poses.map(pose =>
flipPoseHorizontal(pose, imageWidth));\n}\n\nexport function scaleAndFlipPoses(\n  poses: Pose[], [height,
width]: [number, number],\n  [inputResolutionHeight, inputResolutionWidth]: [number, number],\n  padding:
Padding, flipHorizontal: boolean): Pose[] {\n  const scaleY =\n    (height + padding.top + padding.bottom) /

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(inputResolutionHeight);\n const scaleX =\n (width + padding.left + padding.right) /
(inputResolutionWidth);\n\n const scaledPoses =\n scalePoses(poses, scaleY, scaleX, -padding.top, -
padding.left);\n\n if (flipHorizontal) {\n return flipPosesHorizontal(scaledPoses, width);\n } else {\n
return scaledPoses;\n }\n}\n", "\n/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport
{ BaseModel } from './base_model';\nimport { decodeOnlyPartSegmentation, decodePartSegmentation,
toMaskTensor } from './decode_part_map';\nimport
{ MobileNet } from './mobilenet';\nimport { decodePersonInstanceMasks, decodePersonInstancePartMasks } from
'/multi_person/decode_instance_masks';\nimport { decodeMultiplePoses } from
'/multi_person/decode_multiple_poses';\nimport { ResNet } from './resnet';\nimport { mobileNetSavedModel,
resNet50SavedModel } from './saved_models';\nimport { BodyPixArchitecture, BodyPixInput,
BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding } from
'/types';\nimport { PartSegmentation, PersonSegmentation, SemanticPartSegmentation,
SemanticPersonSegmentation } from './types';\nimport { getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D }
from './util';\n\nconst APPLY_SIGMOID_ACTIVATION = true;\nconst FLIP_POSES_AFTER_SCALING =
false;\n\n/**\n * BodyPix model loading is configurable using the following config dictionary.\n *\n *
`architecture`: BodyPixArchitecture. It determines
which BodyPix architecture\n * to load. The supported architectures are: MobileNetV1 and ResNet50.\n *\n *
`outputStride`: Specifies the output stride of the BodyPix model.\n * The smaller the value, the larger the output
resolution, and more accurate\n * the model at the cost of speed. Set this to a larger value to increase speed\n *
at the cost of accuracy. Stride 32 is supported for ResNet and\n * stride 8,16,32 are supported for various MobileNetV1
models.\n *\n * `multiplier`: An optional number with values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by
MobileNet architecture. It is the float\n * multiplier for the depth (number of channels) for all convolution ops.\n *
The larger the value, the larger the size of the layers, and more accurate\n * the model at the cost of speed. Set
this to a smaller value to increase speed\n * at the cost of accuracy.\n *\n * `modelUrl`: An optional string that
specifies
custom url of the model. This\n * is useful for area/countries that
don't have access to the model hosted on\n * GCP.\n *\n * `quantBytes`: An optional number with values: 1, 2, or 4.
This parameter\n * affects weight quantization in the models. The available options are\n * 1 byte, 2 bytes, and 4
bytes. The higher the value, the larger the model size\n * and thus the longer the loading time, the lower the value,
the shorter the\n * loading time but lower the accuracy.\n *\n * export interface ModelConfig {\n architecture:
BodyPixArchitecture;\n outputStride: BodyPixOutputStride;\n multiplier?: BodyPixMultiplier;\n modelUrl?:
string;\n quantBytes?: BodyPixQuantBytes;\n}\n\n// The default configuration for loading MobileNetV1 based
BodyPix.\n// (And for references, the default configuration for loading ResNet\n// based PoseNet is also
included).\n//\n// const RESNET_CONFIG = {\n// architecture: 'ResNet50',\n// outputStride: 32,\n//
quantBytes: 4,\n// } as ModelConfig;\n//\n// const MOBILENET_V1_CONFIG = {\n architecture:
'MobileNetV1',\n
outputStride: 16,\n quantBytes: 4,\n multiplier: 0.75,\n} as ModelConfig;\n\nconst VALID_ARCHITECTURE:
BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\nconst VALID_STRIDE: {[id: string]:
BodyPixOutputStride[]} = {\n 'MobileNetV1': [8, 16, 32],\n 'ResNet50': [32, 16]\n};\n\nconst
VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n 'MobileNetV1': [0.50, 0.75, 1.0],\n 'ResNet50':

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[1.0];\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\nfunction\nvalidateModelConfig(config: ModelConfig): ModelConfig {\n  config = config || MOBILENET_V1_CONFIG;\n  if (config.architecture == null) {\n    config.architecture = 'MobileNetV1';\n  }\n  if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n    throw new Error(\n      `Invalid architecture\n      ${config.architecture}. ` +\n      `Should be one of ${VALID_ARCHITECTURE}`);\n  }\n  if (config.outputStride\n  == null) {\n    config.outputStride = 16;\n  }\n  if\n  (VALID_STRIDE[config.architecture].indexOf(config.outputStride)\n  < 0) {\n    throw new Error(\n      `Invalid outputStride ${config.outputStride}. ` +\n      `Should be one of\n      ${VALID_STRIDE[config.architecture]} ` +\n      `for architecture ${config.architecture}.`);\n  }\n  if\n  (config.multiplier == null) {\n    config.multiplier = 1.0;\n  }\n  if\n  (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n    throw new Error(\n      `Invalid\n      multiplier ${config.multiplier}. ` +\n      `Should be one of ${VALID_MULTIPLIER[config.architecture]} ` +\n      `for architecture ${config.architecture}.`);\n  }\n  if (config.quantBytes == null) {\n    config.quantBytes = 4;\n  }\n  if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n    throw new Error(\n      `Invalid\n      quantBytes ${config.quantBytes}. ` +\n      `Should be one of ${VALID_QUANT_BYTES} ` +\n      `for\n      architecture ${config.architecture}.`);\n  }\n  return config;\n}\n\n**\n * BodyPix inference is configurable using\n the following
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config dictionary.

- `flipHorizontal`: If the left-right keypoint of poses/part segmentation should be flipped/mirrored horizontally. This should be set to true for videos where the video is by default flipped horizontally (i.e. a webcam), and you want the person & body part segmentation to be returned in the proper orientation.
- `internalResolution`: Defaults to 'medium'. The internal resolution percentage that the input is resized to before inference. The larger the internalResolution the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or a percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
- `segmentationThreshold`: The minimum that segmentation values must have to be considered part of the person. Affects the generation of the segmentation mask. More specifically, it is

the threshold used to binarize the intermediate person segmentation probability. The probability of each pixel belongs to a person is in range [0, 1]. If the probability is greater than the `segmentationThreshold`, it will be set to 1 otherwise 0.

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\nexport interface InferenceConfig {\n  flipHorizontal?: boolean;\n  internalResolution?: BodyPixInternalResolution;\n  segmentationThreshold?: number;\n}\n\n**\n * Person\n Inference Config\n * `maxDetections`: Defaults to 10. Maximum number of person pose detections per\n * image.\n * `scoreThreshold`: Defaults to 0.4. Only return person pose that have root\n * part score greater or\n * equal to this value.\n * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n * It\n * needs to be strictly positive. Two pose keypoints suppress each other if\n * they are less than `nmsRadius` pixels\n * away.\n * \nexport interface PersonInferenceConfig extends InferenceConfig {\n  maxDetections?: number;\n  scoreThreshold?:\n  number;\n  nmsRadius?: number;\n}\n\n**\n * Multiple Person Instance Inference Config\n * `maxDetections`: Defaults to 10. Maximum number of returned instance\n * segmentation and pose detections per image.\n * `scoreThreshold`: Defaults to 0.4. Only returns and uses person\n * poses for instance segmentation assignment\n * when the pose has root part score\n * greater or equal to this value.\n * `nmsRadius`: Defaults to 20. Non-\n * maximum suppression part distance in pixels.\n * It needs to be strictly positive. Two parts suppress each other if\n * they are\n * less than `nmsRadius` pixels away.\n * `minKeypointScore`: Default to 0.3. Keypoints above the\n * score are used\n * for matching and assigning segmentation mask to each person.\n * `refineSteps`: Default to\n * 10. The number of refinement steps used when\n * assigning the instance segmentation. It needs to be strictly\n * positive. The\n * larger the higher the accuracy and slower the inference.\n * \nexport\n interface MultiPersonInstanceInferenceConfig extends InferenceConfig {\n  maxDetections?: number;\n  scoreThreshold?: number;\n  nmsRadius?: number;\n  minKeypointScore?: number;\n  refineSteps?:\n  number;\n}\n\nexport const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {\n  flipHorizontal:
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false,\n internalResolution: 'medium',\n segmentationThreshold: 0.7,\n maxDetections: 10,\n scoreThreshold:
0.4,\n nmsRadius: 20,\n);\n\nexport const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG:\n
MultiPersonInstanceInferenceConfig = {\n  flipHorizontal: false,\n  internalResolution: 'medium',\n
segmentationThreshold: 0.7,\n  maxDetections: 10,\n  scoreThreshold: 0.4,\n  nmsRadius: 20,\n
minKeypointScore: 0.3,\n  refineSteps: 10\n };\n\nfunction validatePersonInferenceConfig(config:\n
PersonInferenceConfig) {\n  const {segmentationThreshold, maxDetections, scoreThreshold, nmsRadius} =\n
config;\n\n  if (segmentationThreshold < 0.0 || segmentationThreshold\n
> 1.0) {\n    throw new Error(\n      `segmentationThreshold ${segmentationThreshold}.` +\n      `Should be in\n
range [0.0, 1.0]`);\n  }\n\n  if (maxDetections <= 0) {\n    throw new Error(\n      `Invalid maxDetections\n
${maxDetections}.` +\n      `Should be > 0`);\n  }\n\n  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n    throw\n
new Error(\n      `Invalid scoreThreshold ${scoreThreshold}.` +\n      `Should be in range [0.0, 1.0]`);\n  }\n\n  if\n
(nmsRadius <= 0) {\n    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n  }\n}\n\nfunction\n
validateMultiPersonInstanceInferenceConfig(\n  config: MultiPersonInstanceInferenceConfig) {\n  const {\n
segmentationThreshold,\n  maxDetections,\n  scoreThreshold,\n  nmsRadius,\n  minKeypointScore,\n
refineSteps\n } = config;\n\n  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {\n    throw new\n
Error(\n      `segmentationThreshold ${segmentationThreshold}.` +\n      `Should be in range [0.0,\n
1.0]`);\n  }\n\n  if (maxDetections <= 0) {\n    throw new Error(\n      `Invalid maxDetections ${maxDetections}.`\n
+ \n      `Should be > 0`);\n  }\n\n  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n    throw new Error(\n
`Invalid scoreThreshold ${scoreThreshold}.` +\n      `Should be in range [0.0, 1.0]`);\n  }\n\n  if (nmsRadius <= 0)\n
{\n    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n  }\n\n  if (minKeypointScore < 0 ||\n
minKeypointScore > 1) {\n    throw new Error(\n      `Invalid minKeypointScore ${minKeypointScore}.` +\n\n
`Should be in range [0.0, 1.0]`);\n  }\n\n  if (refineSteps <= 0 || refineSteps > 20) {\n    throw new Error(\n
`Invalid refineSteps ${refineSteps}.` +\n      `Should be in range [1, 20]`);\n  }\n}\n\nexport class BodyPix {\n
baseModel: BaseModel;\n\n  constructor(net: BaseModel) {\n    this.baseModel = net;\n  }\n\n  private\n
predictForPersonSegmentation(input: tf.Tensor3D): {\n    segmentLogits: tf.Tensor3D,\n
heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd:\n
tf.Tensor3D,\n  } {\n    const {\n      segmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n
displacementBwd,\n    } = this.baseModel.predict(input);\n    return {\n      segmentLogits: segmentation,\n
heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n    };\n  }\n\n  private\n
predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n    segmentLogits: tf.Tensor3D,\n
partHeatmapLogits: tf.Tensor3D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd:\n
tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n  } {\n    const {\n      segmentation,\n      partHeatmaps,\n
heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd\n    } = this.baseModel.predict(input);\n
return {\n      segmentLogits: segmentation,\n      partHeatmapLogits: partHeatmaps,\n
heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n    };\n  }\n\n  private\n
predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n    {\n      segmentLogits:\n
tf.Tensor3D,\n      longOffsets: tf.Tensor3D,\n      heatmapScores: tf.Tensor3D,\n      offsets: tf.Tensor3D,\n
displacementFwd: tf.Tensor3D,\n      displacementBwd: tf.Tensor3D,\n      partHeatmaps: tf.Tensor3D\n    } {\n
const {\n      segmentation,\n      longOffsets,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n
displacementBwd,\n      partHeatmaps,\n    } = this.baseModel.predict(input);\n    return {\n      segmentLogits:\n
segmentation,\n      longOffsets,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n
partHeatmaps\n    };\n  }\n}\n\n/**\n * Given an image with people, returns a dictionary of all intermediate\n *
tensors including: 1) a binary array with 1 for the pixels that are part\n
of\n * the person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.\n * @param input\n
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement\n * The input image to feed\n
through the network.\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that\n
the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the\n
cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value

```

between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.

@param segmentationThreshold The minimum that segmentation values must have to be considered part of the person. Affects the generation of the segmentation mask.

@return A dictionary containing 'segmentation', 'heatmapScores', 'offsets', and 'padding':

- segmentation**: A 2d Tensor with 1 for the pixels that are part of the person, and 0 otherwise. The width and height correspond to the same dimensions of the input image.
- heatmapScores**: A 3d Tensor of the keypoint heatmaps used by pose estimation decoding.
- offsets**: A 3d Tensor of the keypoint offsets used by pose estimation decoding.
- displacementFwd**: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding.
- displacementBwd**: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding.
- padding**: The padding (unit pixels) being applied to the input image before it is fed into the model.

```

function segmentPersonActivation(input: BodyPixInput, internalResolution:
BodyPixInternalResolution, segmentationThreshold = 0.5): {
  segmentation: tf.Tensor2D,
  heatmapScores: tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
  padding: Padding,
  internalResolutionHeightAndWidth: [number, number]} {
  const [height, width] = getInputSize(input);
  const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(internalResolution, this.baseModel.outputStride, [height, width]);
  const {resized, padding} = padAndResizeTo(input, internalResolutionHeightAndWidth);
  const {segmentation, heatmapScores, offsets, displacementFwd, displacementBwd} = tf.tidy(() =>
{
  const {segmentLogits, heatmapScores, offsets, displacementFwd, displacementBwd} =
this.predictForPersonSegmentation(resized);
  const [resizedHeight, resizedWidth] = resized.shape;
  const scaledSegmentScores = scaleAndCropToInputTensorShape(segmentLogits,
[height, width], [resizedHeight, resizedWidth], [[padding.top, padding.bottom], [padding.left,
padding.right]], APPLY_SIGMOID_ACTIVATION);
  return {segmentation: toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold),
heatmapScores, offsets, displacementFwd, displacementBwd};
});
  resized.dispose();
  return {segmentation, heatmapScores, offsets, displacementFwd, displacementBwd, padding,
internalResolutionHeightAndWidth};
}

```

*** Given an image with many people, returns a PersonSegmentation dictionary that contains the segmentation mask for all people and a single pose.**

Note: The segmentation mask returned by this method covers all people but the pose works well for one person. If you want to estimate instance-level multiple person segmentation & pose for each person, use 'segmentMultiPerson' instead.

@param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)

*** The input image to feed through the network.**

@param config PersonInferenceConfig object that contains parameters for the BodyPix inference using person decoding.

@return A SemanticPersonSegmentation dictionary that contains height, width, the flattened binary segmentation mask and the poses for all people.

The width and height correspond to the same dimensions of the input image.

- height**: The height of the segmentation data in pixel unit.
- width**: The width of the segmentation data in pixel unit.
- data**: The flattened Uint8Array of segmentation data. 1 means the pixel belongs to a person and 0 means the pixel doesn't belong to a person. The size of the array is equal to 'height' x 'width' in row-major order.
- allPoses**: The 2d poses of all people.

```

async segmentPerson(input: BodyPixInput, config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):
Promise<SemanticPersonSegmentation> {
  config = {...PERSON_INFERENCE_CONFIG, ...config};
  validatePersonInferenceConfig(config);
  const {segmentation, heatmapScores, offsets, displacementFwd, displacementBwd, padding,
internalResolutionHeightAndWidth} =
this.segmentPersonActivation(input, config.internalResolution, config.segmentationThreshold);
  const [height, width] = segmentation.shape;
  const result = await segmentation.data() as Uint8Array;
  segmentation.dispose();
  const tensorBuffers = await toTensorBuffers3D([heatmapScores, offsets, displacementFwd, displacementBwd]);
  const [scoresBuf, offsetsBuf, displacementsFwdBuf,

```

```

displacementsBwdBuf] =\n    tensorBuffers;\n\n    let poses = decodeMultiplePoses(\n        scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n        this.baseModel.outputStride, config.maxDetections,\n        config.scoreThreshold, config.nmsRadius);\n\n    poses = scaleAndFlipPoses(\n        poses, [height, width],
internalResolutionHeightAndWidth, padding,\n        FLIP_POSES_AFTER_SCALING);\n\n    heatmapScores.dispose();\n    offsets.dispose();\n    displacementFwd.dispose();\n    displacementBwd.dispose();\n\n    return {height, width, data: result, allPoses: poses};\n    }\n\n    /**\n     * Given an image with multiple people, returns
an *array* of\n     * PersonSegmentation object. Each element in the array corresponding to one\n     * of the people in
the input image. In other words, it predicts\n     * instance-level multiple person segmentation & pose for each
person.\n     *\n     * The model does standard ImageNet pre-processing before inferring through\n     * the model. The
image pixels should have values [0-255].\n     *\n     * @param input\n     *
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n     * image to feed
through the network.\n     *\n     * @param config MultiPersonInferenceConfig
object that contains\n     * parameters for the BodyPix inference using multi-person decoding.\n     *\n     * @return An
array of PersonSegmentation object, each containing a width,\n     * height, a binary array (1 for the pixels that are
part of the\n     * person, and 0 otherwise) and 2D pose. The array size corresponds to the\n     * number of pixels in the
image. The width and height correspond to the\n     * dimensions of the image the binary array is shaped to, which are
the same\n     * dimensions of the input image.\n     */\n\n    async segmentMultiPerson(\n        input: BodyPixInput,\n
config: MultiPersonInstanceInferenceConfig =\n        MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):\n
Promise<PersonSegmentation[]> {\n        config = { ...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,
...config};\n        validateMultiPersonInstanceInferenceConfig(config);\n        const [height, width] =
getInputSize(input);\n        const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n
            config.internalResolution, this.baseModel.outputStride,\n            [height, width]);\n\n        const {resized, padding}
=\n            padAndResizeTo(input, internalResolutionHeightAndWidth);\n        const {\n            segmentation,\n
longOffsets,\n            heatmapScoresRaw,\n            offsetsRaw,\n            displacementFwdRaw,\n            displacementBwdRaw,\n
} = tf.tidy(() => {\n            const {\n                segmentLogits,\n                longOffsets,\n                heatmapScores,\n                offsets,\n
displacementFwd,\n                displacementBwd,\n            } =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n            const scaledSegmentScores =
scaleAndCropToInputTensorShape(\n                segmentLogits, [height, width], internalResolutionHeightAndWidth,\n
                [[padding.top, padding.bottom], [padding.left, padding.right]],\n                APPLY_SIGMOID_ACTIVATION);\n
const longOffsetsResized = false;\n            let scaledLongOffsets;\n            if (longOffsetsResized) {\n
scaledLongOffsets = scaleAndCropToInputTensorShape(\n
                longOffsets, [height, width], internalResolutionHeightAndWidth,\n                [[padding.top, padding.bottom],
[padding.left, padding.right]],\n                APPLY_SIGMOID_ACTIVATION);\n            } else {\n                scaledLongOffsets
= longOffsets;\n            }\n\n            const segmentation = toMaskTensor(\n                tf.squeeze(scaledSegmentScores),
config.segmentationThreshold);\n\n            return {\n                segmentation,\n                longOffsets: scaledLongOffsets,\n
heatmapScoresRaw: heatmapScores,\n                offsetsRaw: offsets,\n                displacementFwdRaw: displacementFwd,\n
displacementBwdRaw: displacementBwd,\n            };
});\n\n            const tensorBuffers = await toTensorBuffers3D(\n
                [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n            const [scoresBuf,
offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n                tensorBuffers;\n\n            let poses =
decodeMultiplePoses(\n                scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf,\n                this.baseModel.outputStride, config.maxDetections,\n                config.scoreThreshold,
config.nmsRadius);\n\n            poses = scaleAndFlipPoses(\n                poses, [height, width],
internalResolutionHeightAndWidth, padding,\n                FLIP_POSES_AFTER_SCALING);\n\n            const instanceMasks
= await decodePersonInstanceMasks(\n                segmentation, longOffsets, poses, height, width,\n
this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,\n                config.scoreThreshold,
config.refineSteps, config.minKeypointScore,\n                config.maxDetections);\n\n            resized.dispose();\n
segmentation.dispose();\n            longOffsets.dispose();\n            heatmapScoresRaw.dispose();\n            offsetsRaw.dispose();\n
displacementFwdRaw.dispose();\n            displacementBwdRaw.dispose();\n\n            return instanceMasks;\n        }\n    }\n\n    /**\n     *

```

Given an image with many people, returns a dictionary containing: height, width, a tensor with a part id from 0-24 for the pixels that are

* part of a corresponding body part, and -1 otherwise. This does standard ImageNet pre-processing before inferring through the model. The image should have values [0-255].
@param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed through the network.
@param internalResolution Defaults to 'medium'. The internal resolution percentage that the input is resized to before inference. The larger the internalResolution the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or a percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
@param segmentationThreshold The minimum that segmentation values must have to be considered part of the person. Affects the clipping of the colored part image.

@return A dictionary containing `partSegmentation`, `heatmapScores`, `offsets`, and `padding`:
- `partSegmentation`: A 2d Tensor with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise.
- `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by single-person pose estimation decoding.
- `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose estimation decoding.
- `displacementFwd`: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding.
- `displacementBwd`: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding.
- `padding`: The padding (unit pixels) being applied to the input image before it is fed into the model.

```
segmentPersonPartsActivation(input: BodyPixInput,
internalResolution: BodyPixInternalResolution,
segmentationThreshold = 0.5): {
  partSegmentation: tf.Tensor2D,
  heatmapScores: tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
  padding: Padding,
  internalResolutionHeightAndWidth: [number, number]
}
const [height, width] = getInputSize(input);
const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(
  internalResolution, this.baseModel.outputStride, [height, width]);
const { resized, padding } = padAndResizeTo(input, internalResolutionHeightAndWidth);
const { partSegmentation, heatmapScores, offsets, displacementFwd, displacementBwd } =
tf.tidy(() => {
  const { segmentLogits, partHeatmapLogits, heatmapScores, offsets,
  displacementFwd, displacementBwd } = this.predictForPersonSegmentationAndPart(resized);
  const [resizedHeight, resizedWidth] = resized.shape;
  const scaledSegmentScores =
scaleAndCropToInputTensorShape(
  segmentLogits, [height, width], [resizedHeight, resizedWidth],
[[padding.top, padding.bottom], [padding.left, padding.right]],
  APPLY_SIGMOID_ACTIVATION);
  const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(
  partHeatmapLogits, [height, width],
[resizedHeight, resizedWidth],
[[padding.top, padding.bottom], [padding.left, padding.right]],
  APPLY_SIGMOID_ACTIVATION);
  const segmentation =
toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);
  return {
    partSegmentation:
decodePartSegmentation(segmentation, scaledPartHeatmapScore),
    heatmapScores,
    offsets,
    displacementFwd,
    displacementBwd,
  };
});
resized.dispose();
return {
  partSegmentation,
  heatmapScores,
  offsets,
  displacementFwd,
  displacementBwd,
  padding,
}
```

internalResolutionHeightAndWidth];
/** Given an image with many people, returns a PartSegmentation dictionary that contains the body part segmentation mask for all people and a single pose.
* Note: The body part segmentation mask returned by this method covers all people but the pose works well when there is one person. If you want to estimate instance-level multiple person body part segmentation & pose for each person, use `segmentMultiPersonParts` instead.
@param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed through the network.
@param config PersonInferenceConfig object that contains parameters for the BodyPix inference using single person decoding.
@return A SemanticPartSegmentation dictionary that contains height, width, the flattened binary segmentation mask and the pose for the person. The width and

height

correspond to the same dimensions of the input image.
* - `height`: The height of the person part segmentation data in pixel unit.
* - `width`: The width of the person part segmentation data in pixel unit.
* - `data`: The flattened Int32Array of person part segmentation data with a
* part id from 0-24 for the pixels that are part of a corresponding body
* part, and -1 otherwise. The size of the array is equal to `height` x
* `width` in row-major order.
* - `allPoses`: The 2d poses of all people.
*/
async segmentPersonParts(
input: BodyPixInput,
config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):
Promise<SemanticPartSegmentation> {
config = {...PERSON_INFERENCE_CONFIG, ...config};
validatePersonInferenceConfig(config);
const {
partSegmentation,
heatmapScores,
offsets,
displacementFwd,
displacementBwd,
padding,
internalResolutionHeightAndWidth
} =
this.segmentPersonPartsActivation(
input, config.internalResolution, config.segmentationThreshold);
const [height, width] = partSegmentation.shape;
const data = await partSegmentation.data() as Int32Array;
partSegmentation.dispose();
const tensorBuffers = await toTensorBuffers3D(
[heatmapScores, offsets,
displacementFwd, displacementBwd]);
const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =
tensorBuffers;
let poses = decodeMultiplePoses(
scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,
this.baseModel.outputStride, config.maxDetections,
config.scoreThreshold, config.nmsRadius);
poses = scaleAndFlipPoses(
poses, [height, width], internalResolutionHeightAndWidth, padding,
FLIP_POSES_AFTER_SCALING);
heatmapScores.dispose();
offsets.dispose();
displacementFwd.dispose();
displacementBwd.dispose();
return {
height,
width, data, allPoses: poses};
}
/**
* Given an image with multiple people, returns an array of
PartSegmentation
* object. Each element in the array corresponding to one
* of the people in the input image. In other words, it predicts
* instance-level multiple person body part segmentation & pose for each
* person.
* This does standard ImageNet pre-processing before inferring through
* the model. The image pixels should have values [0-255].
* @param input
* ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input
* image to feed through the network.
* @param config MultiPersonInferenceConfig object that contains
* parameters for the BodyPix inference using multi-person decoding.
* @return An array of PartSegmentation object, each containing a width,
* height, a flattened array (with part id from 0-24 for the pixels that are
* part of a corresponding body part, and -1 otherwise)
and 2D pose. The width
* and height correspond to the dimensions of the image. Each flattened part
* segmentation array size is equal to `height` x `width`.
*/
async segmentMultiPersonParts(
input: BodyPixInput,
config: MultiPersonInstanceInferenceConfig =
MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {
config =
{...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};
validateMultiPersonInstanceInferenceConfig(config);
const [height, width] = getInputSize(input);
const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(
config.internalResolution, this.baseModel.outputStride,
[height, width]);
const {
resized, padding
} =
padAndResizeTo(input, internalResolutionHeightAndWidth);
const {
segmentation,
longOffsets,
heatmapScoresRaw,
offsetsRaw,
displacementFwdRaw,
displacementBwdRaw,
partSegmentation,
}
} = tf.tidy(() => {
const {
segmentLogits,
longOffsets,
heatmapScores,
offsets,
displacementFwd,
displacementBwd,
partHeatmaps
}
} =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);
// decoding with scaling
const scaledSegmentScores = scaleAndCropToInputTensorShape(
segmentLogits, [height, width], internalResolutionHeightAndWidth,
[[padding.top, padding.bottom], [padding.left, padding.right]],
APPLY_SIGMOID_ACTIVATION);
// decoding with scaling
const scaledPartSegmentationScores =
scaleAndCropToInputTensorShape(
partHeatmaps, [height, width], internalResolutionHeightAndWidth,
[[padding.top, padding.bottom], [padding.left, padding.right]],
APPLY_SIGMOID_ACTIVATION);
}


```

const scaledLongOffsets = longOffsets;\n    const segmentation = toMaskTensor(\n
tf.squeeze(scaledSegmentScores),
config.segmentationThreshold);\n    const partSegmentation =\n
decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n    return {\n    segmentation,\n    longOffsets:\n
scaledLongOffsets,\n    heatmapScoresRaw: heatmapScores,\n    offsetsRaw: offsets,\n
displacementFwdRaw: displacementFwd,\n    displacementBwdRaw: displacementBwd,\n
partSegmentation\n    };\n    });\n\n    const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScoresRaw,\n
offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n    const [scoresBuf, offsetsBuf,\n
displacementsFwdBuf, displacementsBwdBuf] =\n    tensorBuffers;\n\n    let poses = decodeMultiplePoses(\n
scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride,\n
config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n\n    poses = scaleAndFlipPoses(\n
poses, [height, width], internalResolutionHeightAndWidth, padding,\n
FLIP_POSES_AFTER_SCALING);\n\n    const instanceMasks = await decodePersonInstancePartMasks(\n
segmentation, longOffsets, partSegmentation, poses, height, width,\n    this.baseModel.outputStride,\n
internalResolutionHeightAndWidth, padding,\n    config.scoreThreshold, config.refineSteps,\n
config.minKeypointScore,\n    config.maxDetections);\n\n    resized.dispose();\n    segmentation.dispose();\n
longOffsets.dispose();\n    heatmapScoresRaw.dispose();\n    offsetsRaw.dispose();\n
displacementFwdRaw.dispose();\n    displacementBwdRaw.dispose();\n    partSegmentation.dispose();\n\n    return\n
instanceMasks;\n    }\n\n    public dispose() {\n    this.baseModel.dispose();\n    }\n\n    /**\n    * Loads the MobileNet\n
BodyPix model.\n    */\n    async function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n    const\n
outputStride = config.outputStride;\n    const quantBytes = config.quantBytes;\n    const multiplier =\n
config.multiplier;\n    if (tf == null) {\n    throw new Error(\n
`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n    `also include @tensorflow/tfjs on\n
the page before using this\n    model.`);\n    }\n\n    const url = mobileNetSavedModel(outputStride, multiplier,\n
quantBytes);\n    const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n    const mobilenet = new\n
MobileNet(graphModel, outputStride);\n    return new BodyPix(mobilenet);\n    }\n\n    /**\n    * Loads the ResNet BodyPix\n
model.\n    */\n    async function loadResNet(config: ModelConfig): Promise<BodyPix> {\n    const outputStride =\n
config.outputStride;\n    const quantBytes = config.quantBytes;\n    if (tf == null) {\n    throw new Error(\n
`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n    `also include @tensorflow/tfjs on the\n
page before using this\n    model.`);\n    }\n\n    const url = resNet50SavedModel(outputStride, quantBytes);\n    const\n
graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n    const resnet = new\n
ResNet(graphModel, outputStride);\n    return new BodyPix(resnet);\n    }\n\n    /**\n    * Loads the BodyPix model\n
instance from a checkpoint, with the ResNet\n    * or MobileNet architecture. The model to be loaded is configurable\n
using the\n    * config dictionary ModelConfig. Please find more details in the\n    * documentation of the\n
ModelConfig.\n    */\n    @param config ModelConfig dictionary that contains parameters for\n    * the BodyPix loading\n
process. Please find more details of each parameters\n    * in the documentation of the ModelConfig interface. The\n
predefined\n    * `MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n    * for\n
defining your customized config.\n    */\n    export async function load(config: ModelConfig =\n
MOBILENET_V1_CONFIG):\n    Promise<BodyPix> {\n    config = validateModelConfig(config);\n    if\n
(config.architecture === 'ResNet50') {\n    return loadResNet(config);\n    } else if (config.architecture ===\n
'MobileNetV1') {\n    return loadMobileNet(config);\n    } else {\n
return null;\n    }\n    }\n\n    /**\n    * @license\n    * Copyright 2019 Google LLC. All Rights Reserved.\n    * Licensed under\n
the Apache License, Version 2.0 (the \"License\");\n    * you may not use this file except in compliance with the\n
License.\n    * You may obtain a copy of the License at\n    * http://www.apache.org/licenses/LICENSE-2.0\n    * Unless\n
required by applicable law or agreed to in writing, software\n    * distributed under the License is distributed\n
on an \"AS IS\" BASIS,\n    * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n
implied.\n    * See the License for the specific language governing permissions and\n    * limitations under the\n
License.\n    */

```

```

=====
*\n\n// method copied from bGlu in https://codepen.io/zhaojun/pen/zZmRQe\nexport function cpuBlur(\n
canvas: HTMLCanvasElement|OffscreenCanvas,\n image:\n
HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n blur: number) {\n const
ctx = canvas.getContext('2d');\n let sum = 0;\n const delta = 5;\n const alphaLeft = 1 / (2 * Math.PI * delta *
delta);\n const step = blur < 3 ? 1 : 2;\n for (let y = -blur; y <= blur; y += step) {\n for (let x = -blur; x <= blur; x
+= step) {\n const weight =\n alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n sum +=
weight;\n }\n }\n for (let y = -blur; y <= blur; y += step) {\n for (let x = -blur; x <= blur; x += step) {\n
ctx.globalAlpha = alphaLeft *\n Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n
ctx.drawImage(image, x, y);\n }\n }\n ctx.globalAlpha = 1;\n}\n\n",/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from
'/types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}
from './util';\n\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst offScreenCanvases:\n
{[name: string]: Canvas} = {};\n\ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\ntype
HasDimensions = {\n width: number,\n height: number\n};\n\nfunction isSafari() {\n return
/(^(!?chrome|android).)*safari/i.test(navigator.userAgent);\n}\n\nfunction assertSameDimensions(\n
{width: widthA, height: heightA}: HasDimensions,\n {width: widthB, height: heightB}: HasDimensions,\n
nameA: string,\n nameB: string) {\n if (widthA !== widthB || heightA !== heightB) {\n throw new Error(`error:\n
dimensions must match. ${nameA} has dimensions ${\n widthA}x${heightA}, ${nameB} has dimensions
${widthB}x${heightB}`);\n }\n }\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n const ctx =
canvas.getContext('2d');\n ctx.scale(-1, 1);\n ctx.translate(-canvas.width, 0);\n}\n\nfunction
drawWithCompositing(\n ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n image:\n
Canvas|ImageType,\n compositeOperation: string) {\n ctx.globalCompositeOperation = compositeOperation;\n
ctx.drawImage(image, 0, 0);\n}\n\nfunction createOffScreenCanvas(): Canvas {\n if (typeof document !==
'undefined') {\n return document.createElement('canvas');\n } else if (typeof OffscreenCanvas !== 'undefined')\n
{\n return new OffscreenCanvas(0, 0);\n } else\n
{\n throw new Error('Cannot create a canvas in this context');\n }\n}\n\nfunction
ensureOffscreenCanvasCreated(id: string): Canvas {\n if (!offScreenCanvases[id]) {\n offScreenCanvases[id] =
createOffScreenCanvas();\n }\n return offScreenCanvases[id];\n}\n\nfunction drawAndBlurImageOnCanvas(\n
image: ImageType, blurAmount: number, canvas: Canvas) {\n const {height, width} = image;\n const ctx =
canvas.getContext('2d');\n canvas.width = width;\n canvas.height = height;\n ctx.clearRect(0, 0, width, height);\n
ctx.save();\n if (isSafari()) {\n cpuBlur(canvas, image, blurAmount);\n } else {\n // tslint:disable:no-any\n
(ctx as any).filter = `blur(${blurAmount}px)`;\n ctx.drawImage(image, 0, 0, width, height);\n }\n
ctx.restore();\n}\n\nfunction drawAndBlurImageOnOffScreenCanvas(\n image: ImageType, blurAmount:\n
number,\n offscreenCanvasName: string): Canvas {\n const canvas =
ensureOffscreenCanvasCreated(offscreenCanvasName);\n if (blurAmount ===\n
0) {\n renderImageToCanvas(image, canvas);\n } else {\n drawAndBlurImageOnCanvas(image, blurAmount,\n
canvas);\n }\n return canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n const
{width, height} = image;\n canvas.width = width;\n canvas.height = height;\n const ctx =
canvas.getContext('2d');\n ctx.drawImage(image, 0, 0, width, height);\n}\n\n**\n * Draw an image on a canvas\n
*\n\nfunction renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n canvas.width = image.width;\n

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canvas.height = image.height;\n const ctx = canvas.getContext('2d');\n ctx.putImageData(image, 0,
0);\n}\n\nfunction renderImageDataToOffScreenCanvas(\n image: ImageData, canvasName: string): Canvas {\n
const canvas = ensureOffscreenCanvasCreated(canvasName);\n renderImageDataToCanvas(image, canvas);\n\n
return canvas;\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image
with foreground and background color at
each pixel determined by the\n * corresponding binary segmentation value at the pixel from the output. In\n * other
words, pixels where there is a person will be colored with foreground\n * color and where there is not a person will
be colored with background color.\n * \n * @param personOrPartSegmentation The output from\n *
`segmentPerson`, `segmentMultiPerson`,\n * `segmentPersonParts` or `segmentMultiPersonParts`. They can\n * be
SemanticPersonSegmentation object, an array of PersonSegmentation object,\n * SemanticPartSegmentation object,
or an array of PartSegmentation object.\n * \n * @param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground
color\n * (r,g,b,a) for visualizing pixels that belong to people.\n * \n * @param background Default to {r:0, g:0, b:0,
a: 255}. The background color\n * (r,g,b,a) for visualizing pixels that don't belong to people.\n * \n * @param
drawContour Default to false. Whether to draw the contour around each\n * person's segmentation mask or
body part mask.\n * \n * @param foregroundIds Default to [1]. The integer values that represent\n * foreground. For
person segmentation, 1 is the foreground. For body part\n * segmentation, it can be a subset of all body parts ids.\n
*\n * @returns An ImageData with the same width and height of\n * all the PersonSegmentation in
multiPersonSegmentation, with opacity and\n * transparency at each pixel determined by the corresponding binary\n
* segmentation value at the pixel from the output.\n */\nexport function toMask(\n personOrPartSegmentation:
SemanticPersonSegmentation|\n SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n
foreground: Color = {\n r: 0,\n g: 0,\n b: 0,\n a: 0\n },\n background: Color = {\n r: 0,\n g: 0,\n
b: 0,\n a: 255\n },\n drawContour = false, foregroundIds: number[] = [1]): ImageData {\n if
(Array.isArray(personOrPartSegmentation) &&\n personOrPartSegmentation.length === 0) {\n
return null;\n }\n\n let multiPersonOrPartSegmentation:\n
Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n
PersonSegmentation|PartSegmentation>;\n\n if (!Array.isArray(personOrPartSegmentation)) {\n
multiPersonOrPartSegmentation = [personOrPartSegmentation];\n } else {\n multiPersonOrPartSegmentation =
personOrPartSegmentation;\n }\n\n const {width, height} = multiPersonOrPartSegmentation[0];\n const bytes =
new Uint8ClampedArray(width * height * 4);\n\n function drawStroke(\n bytes: Uint8ClampedArray, row:
number, column: number, width: number,\n radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {\n
for (let i = -radius; i <= radius; i++) {\n for (let j = -radius; j <= radius; j++) {\n if (i !== 0 && j !== 0) {\n
const n = (row + i) * width + (column + j);\n bytes[4 * n + 0] = color.r;\n bytes[4 * n + 1] = color.g;\n
bytes[4 * n + 2] = color.b;\n bytes[4 * n +
3] = color.a;\n }\n }\n }\n }\n\n function isSegmentationBoundary(\n segmentationData:
Uint8Array|Int32Array,\n row: number,\n column: number,\n width: number,\n foregroundIds:
number[] = [1],\n radius = 1,\n ): boolean {\n let numberBackgroundPixels = 0;\n for (let i = -radius; i <=
radius; i++) {\n for (let j = -radius; j <= radius; j++) {\n if (i !== 0 && j !== 0) {\n const n = (row + i) *
width + (column + j);\n if (!foregroundIds.some(id => id === segmentationData[n])) {\n
numberBackgroundPixels += 1;\n }\n }\n }\n }\n return numberBackgroundPixels > 0;\n }\n\n for (let i = 0; i < height; i += 1) {\n for (let j = 0; j < width; j += 1) {\n const n = i * width + j;\n bytes[4 * n + 0]
= background.r;\n bytes[4 * n + 1] = background.g;\n bytes[4 * n + 2] = background.b;\n bytes[4 * n + 3] =
background.a;\n for (let k = 0; k <
multiPersonOrPartSegmentation.length; k++) {\n if (foregroundIds.some(\n id => id ===
multiPersonOrPartSegmentation[k].data[n])) {\n bytes[4 * n] = foreground.r;\n bytes[4 * n + 1] =
foreground.g;\n bytes[4 * n + 2] = foreground.b;\n bytes[4 * n + 3] = foreground.a;\n const
isBoundary = isSegmentationBoundary(\n multiPersonOrPartSegmentation[k].data, i, j, width,\n
foregroundIds);\n if (drawContour && i - 1 >= 0 && i + 1 < height && j - 1 >= 0 &&\n j + 1 < width
&& isBoundary) {\n drawStroke(bytes, i, j, width, 1);\n }\n }\n }\n }\n }\n\n return new

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ImageData(bytes, width, height);\n}\n\nconst RAINBOW_PART_COLORS: Array<[number, number, number]> =
[\n [110, 64, 170], [143, 61, 178], [178, 60, 178], [210, 62, 167],\n [238, 67, 149], [255, 78, 125], [255, 94, 99],
[255, 115, 75],\n [255, 140, 56], [239, 167, 47], [217, 194, 49], [194,
219, 64],\n [175, 240, 91], [135, 245, 87], [96, 247, 96], [64, 243, 115],\n [40, 234, 141], [28, 219, 169], [26, 199,
194], [33, 176, 213],\n [47, 150, 224], [65, 125, 224], [84, 101, 214], [99, 81, 195]\n];\n\n/**\n * Given the output
from person body part segmentation (or multi-person\n * instance body part segmentation) and an array of colors
indexed by part id,\n * generates an image with the corresponding color for each part at each pixel,\n * and white
pixels where there is no part.\n *\n * @param partSegmentation The output from segmentPersonParts\n * or
segmentMultiPersonParts. The former is a SemanticPartSegmentation\n * object and later is an array of
PartSegmentation object.\n *\n * @param partColors A multi-dimensional array of rgb colors indexed by\n * part id.
Must have 24 colors, one for every part.\n *\n * @returns An ImageData with the same width and height of all the
element in\n * multiPersonPartSegmentation, with the corresponding color for each part at\n * each
pixel, and black pixels where there is no part.\n */\n\nexport function toColoredPartMask(\n partSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n partColors: Array<[number, number, number]> =\n
RAINBOW_PART_COLORS): ImageData {\n if (Array.isArray(partSegmentation) && partSegmentation.length
=== 0) {\n return null;\n }\n\n let multiPersonPartSegmentation;\n if (!Array.isArray(partSegmentation)) {\n
multiPersonPartSegmentation = [partSegmentation];\n } else {\n multiPersonPartSegmentation =
partSegmentation;\n }\n\n const {width, height} = multiPersonPartSegmentation[0];\n const bytes = new
Uint8ClampedArray(width * height * 4);\n\n for (let i = 0; i < height * width; ++i) {\n // invert mask. Invert the
segmentation mask.\n const j = i * 4;\n bytes[j + 0] = 255;\n bytes[j + 1] = 255;\n bytes[j + 2] = 255;\n
bytes[j + 3] = 255;\n for (let k = 0; k < multiPersonPartSegmentation.length; k++) {\n const partId =
multiPersonPartSegmentation[k].data[i];\n
if (partId !== -1) {\n const color = partColors[partId];\n if (!color) {\n throw new Error(`No color
could be found for part id ${partId}`);\n }\n bytes[j + 0] = color[0];\n bytes[j + 1] = color[1];\n
bytes[j + 2] = color[2];\n bytes[j + 3] = 255;\n }\n }\n\n return new ImageData(bytes, width,
height);\n}\n\nconst CANVAS_NAMES = {\n blurred: 'blurred',\n blurredMask: 'blurred-mask',\n mask: 'mask',\n
lowresPartMask: 'lowres-part-mask',\n};\n\n/**\n * Given an image and a maskImage of type ImageData, draws the
image with the\n * mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n *
@param image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the
mask. Ideally this should be\n * generated by toMask or toColoredPartMask.\n *\n * @param maskOpacity The
opacity of the mask when drawing it on top of the\n
* image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount How many pixels to
blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If the
result should be flipped horizontally. Defaults\n * to false.\n */\n\nexport function drawMask(\n canvas: Canvas,
image: ImageType, maskImage: ImageData|null,\n maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal =
false) {\n const [height, width] = getInputSize(image);\n canvas.width = width;\n canvas.height = height;\n\n
const ctx = canvas.getContext('2d');\n ctx.save();\n if (flipHorizontal) {\n flipCanvasHorizontal(canvas);\n }\n\n
ctx.drawImage(image, 0, 0);\n\n ctx.globalAlpha = maskOpacity;\n if (maskImage) {\n
assertSameDimensions({width, height}, maskImage, 'image', 'mask');\n const mask =
renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n const blurredMask =
drawAndBlurImageOnOffScreenCanvas(\n mask,\n
maskBlurAmount, CANVAS_NAMES.blurredMask);\n ctx.drawImage(blurredMask, 0, 0, width, height);\n }\n\n
ctx.restore();\n}\n\n/**\n * Given an image and a maskImage of type ImageData, draws the image with the\n *
pixelated mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param
image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the mask.
Ideally this should be\n * generated by toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask
when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param
maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n

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*\n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n *\n * @param
pixelCellWidth The width of each pixel cell. Default to 10 px.\n */\nexport function drawPixelatedMask(\n
canvas: Canvas, image:
ImageType, maskImage: ImageData,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n  pixelCellWidth = 10.0) {\n  const [height, width] = getInputSize(image);\n  assertSameDimensions({ width, height },
maskImage, 'image', 'mask');\n  const mask = renderImageDataToOffScreenCanvas(maskImage,
CANVAS_NAMES.mask);\n  const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n  mask,
maskBlurAmount, CANVAS_NAMES.blurredMask);\n  canvas.width = blurredMask.width;\n  canvas.height =
blurredMask.height;\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n
flipCanvasHorizontal(canvas);\n  }\n  const offscreenCanvas =\n  ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n  const offscreenCanvasCtx =
offscreenCanvas.getContext('2d');\n  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n
offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n  offscreenCanvasCtx.drawImage(\n
blurredMask,
0, 0, blurredMask.width, blurredMask.height, 0, 0,\n  offscreenCanvas.width, offscreenCanvas.height);\n
ctx.imageSmoothingEnabled = false;\n  ctx.drawImage(\n  offscreenCanvas, 0, 0, offscreenCanvas.width,
offscreenCanvas.height, 0,\n  0, canvas.width, canvas.height);\n  // Draws vertical grid lines that are
`pixelCellWidth` apart from each other.\n  for (let i = 0; i < offscreenCanvas.width; i++) {\n  ctx.beginPath();\n
ctx.strokeStyle = '#ffffff';\n  ctx.moveTo(pixelCellWidth * i, 0);\n  ctx.lineTo(pixelCellWidth * i,
canvas.height);\n  ctx.stroke();\n  }\n  // Draws horizontal grid lines that are `pixelCellWidth` apart from each\n
// other.\n  for (let i = 0; i < offscreenCanvas.height; i++) {\n  ctx.beginPath();\n  ctx.strokeStyle = '#ffffff';\n
ctx.moveTo(0, pixelCellWidth * i);\n  ctx.lineTo(canvas.width, pixelCellWidth * i);\n  ctx.stroke();\n  }\n
ctx.globalAlpha = 1.0 - maskOpacity;\n  ctx.drawImage(image, 0, 0, blurredMask.width,
blurredMask.height);\n  ctx.restore();\n  }\n}\nfunction createPersonMask(\n  multiPersonSegmentation:
PersonSegmentation[]|SemanticPersonSegmentation,\n  edgeBlurAmount: number): Canvas {\n  const
backgroundMaskImage = toMask(\n  multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n  {r: 0, g: 0, b: 0, a:
0});\n  const backgroundMask =\n  renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n  return backgroundMask;\n  } else {\n  return
drawAndBlurImageOnOffScreenCanvas(\n  backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image
with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred
image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param
personSegmentation A SemanticPersonSegmentation or an array of\n * PersonSegmentation object.\n
*\n * @param backgroundBlurAmount How many pixels in the background blend into each\n * other. Defaults to
3. Should be an integer between 1 and 20.\n *\n * @param edgeBlurAmount How many pixels to blur on the edge
between the person\n * and the background by. Defaults to 3. Should be an integer between 0 and 20.\n *\n *
@param flipHorizontal If the output should be flipped horizontally. Defaults\n * to false.\n */\nexport function
drawBokehEffect(\n  canvas: Canvas, image: ImageType,\n  multiPersonSegmentation:
SemanticPersonSegmentation|PersonSegmentation[],\n  backgroundBlurAmount = 3, edgeBlurAmount = 3,
flipHorizontal = false) {\n  const blurredImage = drawAndBlurImageOnOffScreenCanvas(\n  image,
backgroundBlurAmount, CANVAS_NAMES.blurred);\n  canvas.width = blurredImage.width;\n  canvas.height =
blurredImage.height;\n  const ctx = canvas.getContext('2d');\n  if (Array.isArray(multiPersonSegmentation)
&&\n  multiPersonSegmentation.length === 0) {\n  ctx.drawImage(blurredImage,
0, 0,\n  0, 0);\n  return;\n  }\n  const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n
ctx.save();\n  if (flipHorizontal) {\n  flipCanvasHorizontal(canvas);\n  }\n  // draw the original image on the final
canvas\n  const [height, width] = getInputSize(image);\n  ctx.drawImage(image, 0, 0, width, height);\n  //
`destination-in` - `The existing canvas content is kept where both the\n // new shape and existing canvas content
overlap. Everything else is made\n // transparent.`\n // crop what's not the person using the mask from the original

```


'left_lower_leg_back',\n 'right_lower_leg_front',\n 'right_lower_leg_back',\n 'left_feet',\n 'right_feet\n'];\n","/**
@license See the LICENSE file. */\n\n// This code is auto-generated, do not modify this file!\nconst version =
'2.2.0';\nexport { version};\n","/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * https://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```
=====\n\n*/\nexport {BodyPix, load} from './body_pix_model';\nexport {blurBodyPart, drawBokehEffect, drawMask,  
drawPixelatedMask, toColoredPartMask, toMask} from './output_rendering_util';\nexport {PART_CHANNELS}  
from './part_channels';\nexport {PartSegmentation, PersonSegmentation, SemanticPartSegmentation,  
SemanticPersonSegmentation} from './types';\nexport {flipPoseHorizontal, resizeAndPadTo,  
scaleAndCropToInputTensorShape} from './util';\nexport {version} from  
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No license file was found, but licenses were detected in source scan.

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M,GA AK,EA EvB,GAAA,EAAU,UAAU,UA Ef,uBACG,qLAIG,MAAY,MAAY,MAAY,8EAGlC,qBACT,EA AkB, oBAKpB,MAAA,EAAa,EAAU,UAAU,WACjC,EA AW,EAAU,UAAU,SAC/B,EAAU,EAAS,GACnB,EAAU,EA AS,GACrB,OAAA,IAAY,GA AyB,MAAd,mBAGf,kMAIG,MAAY,MAAY,MAAY,kHAG3B,QAAc,uCACT,yBA lzB,IAAY,GA AyB,MAAd,mBAGf,sKAGG,EAAM,GA AK,EAAM,GA AK,EAAM,GA AK,EAAM,uBACvC,EAA M,GA AK,EAAM,GA AK,EAAM,uBAC5B,EAAM,GA AK,EAAM,uBACjB,EAAM,8HAGE,QAAc,uCACR,wCA MnB,+LAGc,aAAmB,eAAqB,2BAC7C,gBAAsB,gBAN1B,EA AyB,mCAOb,MAAY,0CACZ,qBAK7B,SAAS,EA AkB,GACnB,MAAA,EAAU,EAAU,KACpB,EAAS,EAAK,KAAA,cAAc,EAAU,UAAU,cAEID,OAAA,EAAS,YA CM,kCAGK,sDAET,4BAMjB,SAAS,EA CL,EAAsB,GACIB,MAAA,EAAU,EAAU,KACpB,EA AiB,EAAQ,OAA O,GAAG,cAAgB,EAAQ,MAAM,GACjE,EA AW,MAAQ,EA AiB,cACpC,EAAS,EAAU,UAAU,aAAa,OAC1C,EA AU,EAAa,aAAa,OA EpC,EA AgB,EACIB,EAAU,UAAU,aAAc,EAAa,cAE7C,EAAO,EA AkB,GACzB,EA AW,EA AU,EACvB,IAAA,EACE,MAAA,EAAS,CAAC,IAAK,IAAK,IAAK,IAAK,IAAK,IAAK,KAGvC,EADa,IAAX,EACc,G ACP,EAAU,GA AK,EA Ac,QAAU,EACHc,cAGZ,EA Ac,IAAI,aAAe,EAAO,EA AI,WACvC,KAAK,MAEZ,IAAA, EAAwB,GAE1B,EADE,EAAU,GA AK,EAAS,EACF,SAEA,EAAU,UAAU,aACf,IAAI,CAAC,EAAG,cAAgB,EA AO,EA AI,MACnC,KAAK,MAGhC,IAAA,EAAS,sBACP,MACA,EAA2B,IADIB,EAAK,KAAA,cAAc,EAAU,UA AU,cAGhD,EAA6B,IADnB,EAAK,KAAA,cAAc,EAAa,cAG5C,GAAW,IAAX,GAAiB,GA AkB,GAIhC,GA AI,IA AkB,EA EzB,EADc,IAAZ,EACO,uEAIA,qDAIN,GA AI,EA Ac,OAAQ,CACzB,MAAA,EAAO,EAAS,EACHb,EA AO,EAAS,EA EIB,EA Ac,QAAQ,IAAS,GA AK,EA Ac,QAAQ,IAAS,EACrE,EAAS,8BACA,EA Ac,QAAQ,IAAS,E ACxC,EAAS,2EAEA,EA Ac,QAAQ,IAAS,IACxC,EAAS,sDAvBX,EAAS,6DA2BJ,oBACE,gBACH,wCACA,kCA CsB,KAAkB,cACxC,eAKR,SAAS,EA CL,EAAsB,GACIB,MAAA,EAAU,EAAU,KACpB,EA AiB,EAAQ,OAAO, GAAG,cAAgB,EAAQ,MAAM,GACjE,EA AW,MAAQ,EA AiB,cACpC,EA Ac,EAAa,SAC3B,EAAa,EAAU,UAAU ,SACjC,EAAS,EAAU,UAAU,aAAa,OAC1C,EAAU,EAAa,aAAa,OA EtC,IAAC,EAAU,UAAU,WAAa,IAAW,GA CX,MAAIC,EAAU,UAAU,YACpB,EAAK,KAAA,YAAY,EAAY,GACxB,uBACG,uCACiB,+BAKvB,MAAA,EA AO,EA AkB,GACzB,EA AgB,EACIB,EAAU,UAAU,aAAc,EAAa,cAC7C,EA AW,EAAU,EACvB,IAAA,EACE,M AAA,EAAS,CAAC,IAAK,IAAK,IAAK,IAAK,IAAK,KAWrC,IAAA,EAAwB,GASrB,qBACG,gBACJ,wCAnBJ,E ADa,IAAX,EACc,GACP,EAAU,GA AK,EA Ac,QAAU,EACHc,cAGZ,EA Ac,IAAI,aAAe,EAAO,EA AI,WACvC,K AAK,0BAeA,KAXd,EADE,EAAU,GA AK,EAAS,EACF,SAEA,EAAU,UAAU,aACf,IAAI,CAAC,EAAG,cAAgB, EAAO,EA AI,MACnC,KAAK,qBAYhC,SA AU,EA AkB,GAC5B,GAAA,GAAQ,EACH,MAAA,MACF,GAAa,IAA T,EACF,MAAA,QACF,GAAa,IAAT,EACF,MAAA,QACF,GAAa,IAAT,EACF,MAAA,QACF,GAAa,IAAT,EAC F,MAAA,QACF,GAAa,IAAT,EACF,MAAA,QAED,MAAA,sBAAsB,0BAKhC,SAAS,EA CL,EA AmB,GA Ef,MA AA,EAA0B,KAAK,MAAM,KAAK,UAAU,IAEnD,OADP,EAAa,UAAU,aAAe,EAC/B,EAGT,SAAS,EA AkB,EA AkB,GACpC,OAAA,EAAS,IAAI,GA AK,EAAO,IAAI,KAAK;:ACznC1C,aAAA,OAAA,eAAA,QAAA,aAAA,CA AA,OAAA,IAAA,QAAA,eAAA,EAAA,QAAA,WAAA,EAAA,QAAA,cAAA,EA5ND,IAAA,EAAA,QAAA,yBA GA,EAAA,EAAA,QAAA,sBAyNC,SA AA,IAAA,GAAA,mBAAA,QAAA,OAAA,KAAA,IAAA,EAAA,IAAA,Q AAA,OAAA,EAAA,WAAA,OAAA,GAAA,EAAA,SA AA,EAAA,GAAA,GAAA,GAAA,EAAA,WAAA,OAAA,E AAA,IAAA,EAAA,IAAA,GAAA,GAAA,EAAA,IAAA,GAAA,OAAA,EAAA,IAAA,GAAA,IAAA,EAAA,GAA A,GAAA,MAAA,EAAA,CAAA,IAAA,EAAA,OAAA,gBAAA,OAAA,yBAAA,IAAA,IAAA,KAAA,EAAA,GAA A,OAAA,UAAA,eAAA,KAAA,EAAA,GAAA,CAAA,IAAA,EAAA,EAAA,OAAA,yBAAA,EAAA,GAAA,KAA A,IAAA,EAAA,KAAA,EAAA,KAAA,OAAA,eAAA,EAAA,EAAA,GAAA,EAAA,GAAA,EAAA,IAAA,OAAA, EAAA,QAAA,EAAA,GAAA,EAAA,IAAA,EAAA,GAAA,EA9KK,SA AU,EACZ,EA AqB,EA AuB,EAC5C,GACI, MAAA,EA AW,EAAQ,SACnB,EAA0B,EAAO,IAAI,CAAC,EAAO,KAC3C,MAAA,EA AuB,CAC3B,aAAc,EAA M,MACpB,SA AU,EAAM,UAAY,KAAO,EAAM,QAAQ,SACjD,UAAW,EAAM,UACjB,UAAU,EAAM,WAAoB ,EAAM,QAAQ,SACID,WAA Y,MAMP,OA Jc,MAAjB,EAAM,SAA0C,MAAvB,EAAM,QAAQ,OACvC,EAAM,Q AAQ,MAAM,WAAa,IACnC,EAAU,WAAa,EAAM,QAAQ,MAAM,YAEtC,CAAC,KAAAM,EA AQ,cAAc,GA AI,U AAA,KA EpC,EA Ae,EA AW,IAAI,GA AK,EA AE,WACrC,EAA0B,CAC9B,aAAc,EAAO,MACrB,SA AU,EAAO,Q AAQ,SACzB,WAAW,EACX,SA AU,EAAO,QAAQ,SACzB,WAA Y,MAER,EAAS,EA AgB,WAC3B,EAAY,EA A c,EAAU,EAAQ,cAE1C,EA Ae,EAAM,cAAc,GAGrC,IAAA,EAA+B,KAC7B,MAAA,EAAS,EAAM,mBAAmB,E AAc,OAAO,GACpB,KAArC,EAAM,EAAA,OAAA,UAAU,mBACIB,EAAS,EAAM,mBAAmB,EA Ac,YAAY,IAI xD,MAAA,EAA2D,GAC5D,IAAA,IAAI,EA AI,EAAG,EA AI,EAAQ,cAAc,OAAQ,IAAK,CAC/C,MAAA,EAAU,

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MzB,SAAS,EAAGB,GACjB,MAAA,EAAO,EAAO,OACbB,GAAA,EAAO,EACH,MAAA,uBAAuB,0BAE3B,GAAS,IAAT,EACK,qBA Ae,EAAO,MAGzB,MAAA,EAAGB,CAAC,UAAW,UAAW,UAAW,UAAW,WAE7D,EA Ae,GACbB,IAAA,IAAI,EA AI,EAAG,EA AI,EAAO,OAAQ,IACjC,EAAa,aAAa,EA Ac,OAAO,EAAO,OAEjD,OAAA,EAAa,OACrB,QAAA,YAAA;;ACfM,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,KAAA,EAAA,QAAA,gBAAA,EA7BP,IAAA,EAAA,QAAA,yBAGA,EAAA,QAAA,0BACA,EAAA,QAAA,eAEM,SAAU,EACZ,GA EI,MAAA,OAAC,EAAD,QAAS,EAAT,MAAkB,GAAS,GAC3B,EAAC,GA AK,GACN,KAAC,GAAQ,EAEX,GAAY,WAAZ,EAAE,MAAoB,CAGIB,MACA,EADO,EA AQ,SAAS,EAAE,QACP,IAAI,GA AK,EA AK,KAAA,aAAa,IAC9C,GAAM,EAAO,EAAA,QAAA,EAAE,MAAO,EAAE,MAAO,GAC/B,GAAS,EAAY,EAAA,aAAA,EA AK,GACzB,OAAA,EA AQ,eAAe,EAAO,MAAO,EAAO,MAAO,EAAO,QAG7D,MAAA,EAAU,IAAI,EA AJ,YAAgB,EAAE,MAAO,GAGIC,OAFQ,EA AQ,gBAAGB,EAAS,CAAC,GA AI,EAAE,OAKID,MAAM,EAA2B,CACtC,WAA Y,EAD0B,KA EtC,YAAa,QACb,WAA Y,GAHP,QAAA,WAAA;;ACLA,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,KAAA,EAAA,QAAA,gBAAA,EAxBP,IAAA,EAAA,QAAA,yBAGA,EA AA,QAAA,0BAEM,SAAU,EACZ,GA EI,MAAA,OAAC,EAAD,QAAS,EAAT,MAAkB,GAAS,GAC3B,EAAC,GA AK,GACN,EAAC,EAAD,OAAI,GAAU,EA Ed,EA AQ,EA AQ,SAAS,EAAE,SAC1B,EAAa,IACbB,EAAY,EAAA,aAAA,EAAO,EAAE,MAAO,EAAE,MAAoB,EAAG,GA ExD,MAAA,CACL,EA AQ,eACJ,EAAY,MAAO,EAAY,MAAO,EAAY,QACtD,EA AQ,eACJ,EA Ae,MAAO,EA Ae,MAAO,EA Ae,SAI5D,MAAM,EAA2B,CACtC,WAA Y,EAD0B,KA EtC,YAAa,QACb,WAA Y,GAHP,QAAA,WAAA;;ACIA,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,OAAA,EAAA,QAAA,kBAAA,EA5BP,IAAA,EAAA,QAAA,yBAGA,EA AA,QAAA,0BACA,EAAA,QAAA,iBAEM,SAAU,EACZ,GAGI,MAAA,OAAC,EAAD,MAAS,EAAT,QAAGB,GA AW,GAC3B,KA AC,GAAQ,GACT,EAAC,GA AK,GACK,EAAA,EAAA,kBAAA,EAAG,UAGpB,QAAQ,KACJ,YACA,8DACE,MAAA,EAAS,EA AQ,SAAS,EAAE,SAC5B,aAAC,EAAD,YAAe,EA Af,QAA4B,IAC9B,EA Ac,EAAA,eAAA,EA AQ,EAAM,EAAE,MAAO,EAAE,OACpC,MAAA,CACL,EA AQ,eAAe,EAAa,EAAE,MAAO,GAC7C,EA AQ,eAAe,CAAC,EA AQ,QAAS,QAAS,IAI/C,MAAM,EAA6B,CACxC,WAA Y,EAD4B,OA ExC,YAAa,QACb,WAA Y,GAHP,QAAA,aAAA;;ACuBA,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,OAAA,EAAA,QAAA,kBAAA,EAnDP,IAAA,EAAA,QAAA,yBAIA,EAAA,QAAA,aACA,EAAA,QAAA,WAEM,SAAU,EACZ,GAGI,MAAA,OAAC,EAAD,QAAS,EAAT,MAAkB,GAAS,GAC3B,MAAC,GAAS,EACZ,IAAA,KAAC,GAAQ,EAET,EAAO,IACT,GAAQ,EAAM,MAAM,QAGhB,MAAA,EA AI,EACJ,EA AQ,EA AE,MAAM,OA EhB,EAAM,EAAM,MAAM,GACIB,EA AQ,IAAI,MAAM,EA AQ,GACzC,IAAA,EA AW,EACV,IAAA,IAAI,EA AI,EA AG,EA AI,EA AO,IACrB,IAAM,IACR,EAAS,KA Ac,EAAE,MAAM,IAI7B,MAAA,EAAY,GA EZ,EA AQ,IAAI,MAAM,GA AO,KA AK,GAC9B,EAAO,EAAE,MAAM,QACrB,EA AK,GAAQ,EACP,MAAA,EA AoB,IAAI,MAAM,GAC/B,IAAA,IAAI,EA AI,EA AG,EA AI,EA AI,OAAQ,IAAK,CACnC,EAAM,GAAQ,EACR,MAAA,GAAS,EAAM,EAAA,OAAA,CAAC,OAAQ,CAAC,EAAA,GA AI,QAAA,EAAS,MAAO,CAAC,MAAA,EAAO,KAAA,KACrD,GACF,EA AQ,EAAA,SAAA,CAAC,OAAQ,CAAC,EAAG,GAAS,QAAA,EAAS,MAAO,CAAC,MAAO,KAC1D,EA AI,GA AK,EA ET,EAAU,KA AK,GA IV,OADP,EAAU,QAAQ,GA AK,EA AQ,8BAA8B,IACtD,EAGF,MAAM,EAA6B,CACxC,WAA Y,EAD4B,OA ExC,YAAa,QACb,WAA Y,GAHP,QAAA,aAAA;;AChDsB,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,sBAAA,EA AvB,MAAO,EAKX,YACI,EACA,GANJ,KAAA,cAAGB,CAAC,IAAK,cAOd,MAAA,EAAa,EAAU,WACvB,EAAY,EAAU,UACtB,EAAS,EAAU,OACnB,EA Ac,EAAU,YACxB,EAAU,EA Ac,KA AK,KA AK,EAAS,GAC5C,KAAA,YAAc,CAAC,EA AW,GA EzB,MAGA,EA AQD,EA A7B,KAAK,MAAM,EAAa,GACd,EAA0B,EAAa,EA EvC,EA AGB,sDAIIB,IAAA,EA AwB,GACxB,EAAS,EAAa,IACxB,yCAC8B,kEAM5B,IAAA,EAA4B,GAC5B,EAAS,EAAa,IACxB,yCAC8B,mDAM3B,KAAA,oHAIC,2GAKA,2PASE,eAAyB,+DACmB,yEAI1B,2lBAgBIB,kDAGqB,mBACS,IAA5B,8aAiBF,yBACqC,IAA5B,obAeT,yBACqC,IAA5B,+eAeT,6DAvliB,QAAA,iBAAA;;ACyFtB,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QA AA,mBAAA,EAAA,QAAA,8BAAA,EA5FP,IAAA,EAAA,QAAA,yBAGA,EAAA,QAAA,kBAEA,EAAA,QAAA,WACA,EAAA,QAAA,aACA,EAAA,QAAA,UACA,EAAA,QAAA,eAEM,SAAU,EA AmB,GAK3B,MAAA,OA AC,EAAD,QAAS,EAAT,MAAkB,GAAS,GAC3B,EAAC,EAAD,WAAI,GA Ac,GACIB,YAAC,GA Ae,EA EhB,EA AQ,EA AE,MAAM,OA EhB,EAAY,GA Ed,IAAA,EAAO,EACL,MAAA,EA Ac,EAAa,aAAA,mBAAmB,CAAC,GAAO,GACxD,IAAA,EAAY,EACG,MA Af,IACF,GAAY,EAAU,EAAA,WAAA,CAAC,OAAQ,CAAC,EAAA,GA AI,QAAA,EAAS,MAAO,CAAC,KAAM,KAC3D,EAAU,KA AK,GACf,EAAO,EAAa,aAAA,iBA AiB,EAAG,GA AO,I

AG3C,MAAA,EA AW,EA Aa,aAAA,aAAa,gBACvC,EAAU,MAAO,EAAM,GACrB,EAAS,EA AK,KAAA,cAAc,C AAC,EAAU,MAAM,KAC7C,GACF,EA AQ,EA AA,SAAA,CAAC,OAAQ,CAAC,EAAG,GAAY,QAAA,EAAS,M AAO,CAAC,MAAO,EA AE,EA AG,MACIE,EAAU,KAAK,GAET,MAAA,GA Ac,EA AW,EA AA,YAAA,EA AE,O AE3B,EACF,CAAC,EA Ae,EA AiC,EACHD,EA AiB,KACV,MAAA,EA AY,EA AE,MAAM,GACpB,EA AS,EA AE, MAAM,GACjB,EACF,EA Aa,aAAA,aAAa,8BACtB,EA AQ,GACV,EA AY,CAAC,WAAA,EA AY,OAAA,EA AQ, UAAA,EA AW,YAAA,GAC5C,EAAU,IAAI,EA AJ,iBA AqB,EA AW,GAC1C,EA AS,EA AQ,cAAc,EA AS,CAAC,E AAG,GAAa,GAG3D,GA FJ,EAAU,KAAK,GA EX,EA AO,MAAM,KAAO,EACf,OAAA,EA EH,MAAA,GA AY,EA AM,EA AA,OAAA,CACtB,QAAA,EACA,MAAO,CAAC,MAAO,EA AG,KAAM,EA Aa,KAAM,EA AG,MAAO,a AEjD,GA AW,EA AK,EA AA,MAAA,CACpB,OAAQ,CAAC,EA AG,GACZ,QAAA,EACA,MAAO,CAAC,KAAM, CAAC,EA AS,MA QnB,OALP,EAAU,KAAK,GACf,EAAU,KAAK,GAGX,EA Aa,EA AQ,EA AW,EAAU,EA AO,IA IrD,EA Ac,EACHb,EA AK,qBAAsB,EA AY,EA Aa,GA EID,GACF,EA AQ,EA AA,SAAA,CAAC,OAAQ,CAAC,EA AG,GA Ac,QAAA,EA AS,MA AO,CAAC,MAAO,KAE3D,IAAA,EA AS,EACT,GA Ae,MA Af,EA AqB,CACvB,EA AU,KAAK,GACT,MAAA,EA AO,EA Aa,aAAA,uBA AuB,GACjD,GA AS,EAAU,EA AA,WAAA,CAAC,OAAQ,C AAC,EA AG,GA AS,QAAA,EA AS,MA AO,CAAC,KAAA,KAIrD,OADP,EAAU,QAAQ,GA AK,EA AQ,8BAA8B,I ACtD,EAGF,MAAM,EA AyC,CACpD,WA AY,EADwC,mBA EpD,YAAa,QACb,WA AY,GA HP,QAAA,yBAAA;; AC4NN,aAzTD,IAAA,EA AA,QAAA,yBA EA,EA AA,QAAA,0BACA,EA AA,QAAA,iBACA,EA AA,QAAA,kBA CA,EA AA,QAAA,mBACA,EA AA,QAAA,iBACA,EA AA,QAAA,kBACA,EA AA,QAAA,iBACA,EA AA,QAAA,i BACA,EA AA,QAAA,oBACA,EA AA,QAAA,oBACA,EA AA,QAAA,kBACA,EA AA,QAAA,mBACA,EA AA,QA AA,kBACA,EA AA,QAAA,mBACA,EA AA,QAAA,mBACA,EA AA,QAAA,qBACA,EA AA,QAAA,uBACA,EA A A,QAAA,2BACA,EA AA,QAAA,yBACA,EA AA,QAAA,yBACA,EA AA,QAAA,uBACA,EA AA,QAAA,4BACA, EA AA,QAAA,sBACA,EA AA,QAAA,kBACA,EA AA,QAAA,kBACA,EA AA,QAAA,yBACA,EA AA,QAAA,qBA CA,EA AA,QAAA,wBACA,EA AA,QAAA,oBACA,EA AA,QAAA,oBACA,EA AA,QAAA,kCACA,EA AA,QAAA, iCACA,EA AA,QAAA,oBACA,EA AA,QAAA,oCACA,EA AA,QAAA,mCACA,EA AA,QAAA,iBACA,EA AA,QA AA,kBACA,EA AA,QAAA,2BACA,EA AA,QAAA,oBACA,EA AA,QAAA,2BACA,EA AA,QAAA,0BACA,EA AA ,QAAA,mCACA,EA AA,QAAA,iDACA,EA AA,QAAA,gDACA,EA AA,QAAA,kBACA,EA AA,QAAA,wBACA,E AAA,QAAA,iBACA,EA AA,QAAA,qBACA,EA AA,QAAA,mBACA,EA AA,QAAA,iBACA,EA AA,QAAA,iBAC A,EA AA,QAAA,wBACA,EA AA,QAAA,mBACA,GAAA,QAAA,iBACA,GAAA,QAAA,kBACA,GAAA,QAAA, 2BACA,GAAA,QAAA,mBACA,GAAA,QAAA,sBACA,GAAA,QAAA,wBACA,GAAA,QAAA,yBACA,GAAA, QAAA,kCACA,GAAA,QAAA,sBACA,GAAA,QAAA,sBACA,GAAA,QAAA,qBACA,GAAA,QAAA,0BACA,G AAA,QAAA,sBACA,GAAA,QAAA,kBACA,GAAA,QAAA,kBACA,GAAA,QAAA,sBACA,GAAA,QAAA,mBA CA,GAAA,QAAA,mBACA,GAAA,QAAA,uBACA,GAAA,QAAA,kBACA,GAAA,QAAA,uBACA,GAAA,QAA A,sBACA,GAAA,QAAA,iBACA,GAAA,QAAA,mBACA,GAAA,QAAA,wBACA,GAAA,QAAA,wBACA,GAA A,QAAA,uBACA,GAAA,QAAA,iBACA,GAAA,QAAA,qBACA,GAAA,QAAA,iBACA,GAAA,QAAA,qBACA, GAAA,QAAA,qBACA,GAAA,QAAA,uBACA,GAAA,QAAA,2BACA,GAAA,QAAA,yBACA,GAAA,QAAA,+B ACA,GAAA,QAAA,kBACA,GAAA,QAAA,iBACA,GAAA,QAAA,qBACA,GAAA,QAAA,uBACA,GAAA,QAA A,iBACA,GAAA,QAAA,yBACA,GAAA,QAAA,sBACA,GAAA,QAAA,iBACA,GAAA,QAAA,iCACA,GAAA,Q AAA,iCACA,GAAA,QAAA,iCACA,GAAA,QAAA,sBACA,GAAA,QAAA,oBACA,GAAA,QAAA,sBACA,GAA A,QAAA,kBACA,GAAA,QAAA,mBACA,GAAA,QAAA,iBACA,GAAA,QAAA,mBACA,GAAA,QAAA,kBAC A,GAAA,QAAA,mBACA,GAAA,QAAA,kBACA,GAAA,QAAA,qBACA,GAAA,QAAA,wBACA,GAAA,QAAA ,kBACA,GAAA,QAAA,mBACA,GAAA,QAAA,qBACA,GAAA,QAAA,4BACA,GAAA,QAAA,gCACA,GAAA, QAAA,mCACA,GAAA,QAAA,uCACA,GAAA,QAAA,qBACA,GAAA,QAAA,8BACA,GAAA,QAAA,mBACA, GAAA,QAAA,mBACA,GAAA,QAAA,uBACA,GAAA,QAAA,oBACA,GAAA,QAAA,kBACA,GAAA,QAAA,q BACA,GAAA,QAAA,kBACA,GAAA,QAAA,iBACA,GAAA,QAAA,kBACA,GAAA,QAAA,mBACA,GAAA,Q AAA,qBACA,GAAA,QAAA,sBACA,GAAA,QAAA,4BACA,GAAA,QAAA,2BACA,GAAA,QAAA,oBACA,GA AA,QAAA,kBACA,GAAA,QAAA,oBACA,GAAA,QAAA,+BACA,GAAA,QAAA,kBACA,GAAA,QAAA,0BAC A,GAAA,QAAA,iBACA,GAAA,QAAA,iBACA,GAAA,QAAA,iBACA,GAAA,QAAA,kBACA,GAAA,QAAA,k BACA,GAAA,QAAA,kBACA,GAAA,QAAA,uBACA,GAAA,QAAA,oBACA,GAAA,QAAA,oBACA,GAAA,Q AAA,gCACA,GAAA,QAAA,uBAGA,MAAM,GA AgC,CACpC,GADoC,UA EpC,GA FoC,cAGpC,EA HoC,mBA Ip

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W,EA AW,EA AkB,GAC1C,MAAO,CACL,EAAG,EA AQ,IAAI,EAAG,EAAG,GACrB,EAAG,EA AQ,IAAI,EAAG
,EAAG,EA AW,EAAA,gBAIpC,SAAGb,EACZ,EAAY,EAAsB,GAC7B,IACD,EAAA,EADC,EAAA,SAAU,EA
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,EA Ae,EACIC,EAAG,EA AK,SAAW,EA Ae,GA ItC,SAAGb,EA Aa,EAAY,GAGvC,IAFA,IAAM,EAAC,IAAI,MA
AM,GA ErB,EA AI,EAAG,EA AI,EAAM,IACxB,EA AO,GA AK,EAGd,OAAO,EAGT,SAAGb,EAAM,EA AW,EA A
a,GAC5C,OA AI,EA AI,EACC,EA EL,EA AI,EACC,EA EF,EAGT,SAAGb,EACZ,EAAY,EAAY,EAAY,GACtC,IA
AM,EA AK,EA AK,EACV,EA AK,EA AK,EACb,OAAO,EA AK,EA AK,EA AK,EAGxB,SAAGb,EA AW,EA Aa,G
ACtC,MAAO,CAAC,EAAG,EA AE,EA AI,EA AE,EAAG,EAAG,EA AE,EA AI,EA AE,GAGnC,SAAGb,EAAY,EA
Aa,EA Aa,GACpD,MAAO,CAAC,EAAG,EAAM,EA AE,EAAG,EA AK,GAAM,EAAG,EAAM,EA AE,EAAG,EA A
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X,EAAS,EACJ,EA AI,EAAG,EA AI,EA AU,OAAQ,IACb,EA AK,UAAU,GAAG,MAAQ,IAC5B,GA AU,EACV,G
AAY,KAAA,IAAC,EA AU,GAAG,EA AI,EA AK,UAAU,GAAG,SAAS,EAAM,GAC3D,KAAA,IAAC,EA AU,GA

AG,EAAl,EAak,UAAU,GAAG,SAAS,EAAM,IAQ3D,OALe,IAAX,EACF,EAaw,EAAA,EAEX,GAAsB,EAejB ,EAGT,SAAS,EAcl,EAagB,EACbB,EAAoC,OADnB,EAAA,EAAA,GAAM,EAAA,EAAA,GACtB,EAAA,EAA A,GAAQ,EAAA,EAAA,GACL,EAAl,KAAK,QAAQ,EAao,EAAS,EAAl,GAao,EAAS,GAao,GAElE,MAAO, CAAC,EADE,KAAK,QAAQ,EAao,EAAS,EAAl,GAao,EAAS,GAao,GACvD,EAAC,GAGd,SAAS,EAcl,EA AgB,EACbB,EAayC,EACzC,EAA2B,EAC3B,GAQF,QARG,EAAA,EAAA,GAAQ,EAAA,EAAA,GACL,EAac, EAakB,GAehc,EAak,EAAY,EAAl,EAAoB,EAAY,EACvD,EAak,EAAY,EAAA,eAAiB,EAAl,GAAM,GAC5 C,EAak,EAAY,EAAA,eAAiB,EAAl,EAak,GAak,GACbD,EAAl,EAAS,EAAl,EACjB,EAAl,EAAS,EAAl,EA CZ,EAAl,EAAG,EAAl,EAAa,IAAK,CACpC,EAAl,KAAK,IAAl,EAAG,EAAS,GAeZB,IAAM,EAAS,EAakB,C AAC,EADIC,EAAl,KAAK,IAAl,EAAG,EAAQ,GACa,EAAC,IACbC,EAak,EAAO,EAAl,EAAoB,EAAO,EAGj D,GAFa,EAak,EAAY,EAAA,eAAiB,EAAl,GAAM,GAG5C,GAFa,EAak,EAAY,EAAA,eAAiB,EAAl,EAak, GAAK,GAKID,MAAO,CAAC,EAAC,EAAE,EAAC,GAGd,SAAS,EAcl,EAagB,EAA2B,EAC3C,EAA2B,EAC3 B,EAAoC,EACpC,EAamC,EACnC,GAKF,QAR8B,EAAA,EAAA,GAAM,EAAA,EAAA,GACjC,EAAA,EAAA, GAAQ,EAAA,EAAA,GACR,EAAA,EAAA,GAAQ,EAAA,EAAA,GAEL,EAagB,GACbB,EAAoB,SAAC,GACv B,OAAA,EAayB,EAAM,CAAC,EAAM,GAao,CAAC,EAAQ,GAAS,IAE1D,EAaiB,EAAG,EAaiB,EACzC,IA AkB,CACrB,IAAM,EAAY,EACd,EAAU,EAagB,EAamB,EAC7C,EAAa,EAAa,CAAC,EAAQ,IAEvC,EAAM,K AAK,GAKb,IAFA,IAAl,GAAQ,EACR,EAaw,EAAA,EACN,EAAl,EAAG,EAAl,EAAM,OAAQ,IAAK,CACrC,I AAM,EAAO,EAagB,EAAO,EAAM,IACiC,EAAO,IACT,EAAO,EACP,EAaw,GAGf,OAAO,EAGT,SAAS,EAC L,EACA,OADC,EAAA,EAAA,GAakB,EAAA,EAAA,GAIrB,MAAO,CAFmB,KAAK,OAAO,EAamB,GAao,E AAS,GAC/C,KAAK,OAAO,EAamB,GAao,EAAS,IAI3E,SAagB,EACZ,EAA0B,EAC1B,EAayB,EAagB,EAA e,EACxD,EAauC,EACvC,EAaqB,OADpB,EAAA,EAAA,GAAU,EAAA,EAAA,QACU,IAAA,IAAA,EAAA,GA UvB,IATA,IAAM,EACF,EAagB,IAAl,SAAS,GAak,OAAA,IAAl,WAaw,EAAS,GAao,KAAK,KAE1D,EAA A,EAAA,IAAW,EAAA,EAAA,KAEZ,EAAA,EAAA,SAAS,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC, EAAA,EAAA,GAAQ,EAAA,EAAA,GAER,EAAA,EAAA,CAAA,EAAA,GAAA,GAAA,GAEE,EAAl,EAAG,EA Al,EAAQ,GAak,EAC/B,IAAK,IAAl,EAAl,EAAG,EAAl,EAAO,GAak,EAAG,CACjC,IAAM,EAAl,EAAl,EA AQ,EAETb,GAAa,IADA,EAAa,GACV,CACd,IAAM,EAAO,EACT,CAAC,EAAG,EAAG,EAAG,GAAl,EAAa,EA AiB,EAC5C,CAAC,EAAM,GAao,CAAC,EAAQ,GAAS,EAamB,CAAC,EAAQ,GAC5D,EAAQ,GACR,GAAQ,I ACV,EAaw,GAAM,GAak,IAM9B,OAAO,EAGT,SAagB,EACZ,EAA0B,EAC1B,EAA6B,EAayB,EACtD,EA Ae,EAagB,EAC/B,EAakB,EACIB,OAFgC,EAAA,EAAA,GAAU,EAAA,EAAA,QAE1C,IAAA,IAAA,EAAA,G AWF,IAVA,IAAM,EACF,EAagB,IAAl,SAAS,GAak,OAAA,IAAl,WAaw,EAAS,GAao,MAAM,KAE3D,EA AA,EAAA,IAAW,EAAA,EAAA,KAEZ,EAAA,EAAA,SAAS,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC, EAAA,EAAA,GAAQ,EAAA,EAAA,GAER,EAAA,EAAA,CAAA,EAAA,GAAA,GAAA,GAGE,EAAl,EAAG, EAAl,EAAQ,GAak,EAC/B,IAAK,IAAl,EAAl,EAAG,EAAl,EAAO,GAak,EAAG,CACjC,IAAM,EAAl,EAAl,EA AQ,EAETb,GAAa,IADA,EAAa,GACV,CACd,IAAM,EAAO,EACT,CAAC,EAAG,EAAG,EAAG,GAAl,EAAa, EAAiB,EAC5C,CAAC,EAAM,GAao,CAAC,EAAQ,GAAS,EAamB,CAAC,EAAQ,GAC5D,EAAQ,GACR,GAA Q,IACV,EAaw,GAAM,GAak,EAagB,KAM9C,OAAO,EAjET,QAAA,uBAAA,EAiCa,QAAA,2BAAA;;oECiI A,IAAA,EAAA,QAAA,yBAGA,EAAA,QAAA,gBAEA,EAAA,QAAA,UAEA,SAagB,EACZ,EAA2B,EAC3B,EA AyB,EAagB,EAae,EACxD,EAauC,EACvC,EAaqB,EACrB,GAaF,QaFg,EAAA,EAAA,GAAU,EAAA,EAAA, GAIP,EAAA,EAAA,MAAC,EAAA,EAAA,GAAY,EAAA,EAAA,GAEB,EAAA,EAAA,MAAA,MAAA,EAAA,G AAC,EAAA,EAAA,GAaw,EAAA,EAAA,GAeZ,EACF,EAAG,QAAQ,EAAa,CAAC,EAaw,EAau,EAAG,EA AA,gBAK/C,EAaw,IAAl,aAAa,EAae,EAAA,cAAgB,GAAG,KAAK,GACbE,EAAl,EAAG,EAAl,EAagB,OAA Q,IAG1C,IAFA,IAAM,EAAa,EAAl,EAAA,cAAgB,EACjC,EAAO,EAagB,GACpB,EAak,EAAG,EAak,EAAA, cAAe,IAAM,CACzC,IAAM,EAaw,EAak,UAAU,GAC1B,EAAS,EAakB,EAAL,EAC5B,EAAS,GAAU,EAAS, MAC5B,EAAS,EAAS,GAak,EAAS,SAAS,EACzC,EAAS,EAAS,GAak,EAAS,SAAS,EAivC,IAAA,EAAA,EA AA,SAAS,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAGT,EAa c,EAAG,OAAO,EAau,CAAC,EAac,EAAA,cAAe,IAE/D,EAAA,EAAA,IAAW,EAAA,EAAA,KAEZ,EAaiC,C ACrC,cAAe,CAAC,eAagB,cAAe,SAC/C,YAAa,CAAC,EAAY,GAC1B,SAAU,gyCAsCD,EAAl,KAAK,EAAM, KAAK,EAAM,0EAE1B,EAAl,KAAK,EAAM,KAAK,EAAM,2FAIX,EAAY,mGAGV,EAAA,cAAa,6PAOX,EA A W,4DACK,EAAS,GAAG,wDACZ,EAAQ,GAAG,iGAGjC,EAAl,KAAK,EAAM,KAAK,EAAM,6FAE1B,EAAl,K

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K,CACzC,IAAM,EACF,EAAYB,EAAGB,EAAC,EAAQ,GA7D,EAAC,EAAA,eACb,EAASB,EAAG,EAASB,EA
AG,EACID,GAEl,EAaiB,EAAA,WACb,CACE,EAAG,EAASB,EAAl,EAC7B,EAAG,EAASB,EAAl,GAElB,CAA
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,UAAU4N,oBAAsB5N,UAAU6N,gBAE9CF", "file":"demos.ab0c720b.js", "sourceRoot":"..", "sourcesContent":["/**

\n
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*\n\nimport {Backend, DataId} from './tensor';\nimport {BackendValues, DataType} from './types';\n\nexport
const EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 = 1e-4;\n\n//
Required information for all backends.\nexport interface BackendTimingInfo {\n kernelMs: number|{\n error:
string};\n getExtraProfileInfo?(): string; // a field for additional timing information\n // e.g.
packing / unpacking for WebGL backend\n}\n\nexport interface TensorStorage {\n read(dataId: DataId):
Promise<BackendValues>;\n readSync(dataId: DataId): BackendValues;\n disposeData(dataId: DataId, force?:
boolean): boolean;\n write(values: BackendValues, shape: number[], dtype: DataType): DataId;\n move(\n
dataId: DataId, values: BackendValues, shape: number[], dtype: DataType,\n refCount: number): void;\n
memory(): {unreliable: boolean}; // Backend-specific information.\n /** Returns number of data ids currently in
the storage. *\n numDataIds(): number;\n refCount(dataId: DataId): number;\n}\n\n/** Convenient class for
storing tensor-related data. *\nexport class DataStorage<T> {\n private data = new WeakMap<DataId, T>();\n
private dataIdsCount = 0;\n constructor(private backend: KernelBackend, private dataMover: DataMover) {\n}\n
get(dataId: DataId) {\n if (!this.data.has(dataId)) {\n this.dataMover.moveData(this.backend, dataId);\n }\n
return this.data.get(dataId);\n }\n set(dataId: DataId, value: T): void {\n this.dataIdsCount++;\n
this.data.set(dataId, value);\n }\n has(dataId: DataId): boolean {\n return this.data.has(dataId);\n }\n
delete(dataId: DataId): boolean {\n this.dataIdsCount--;\n return this.data.delete(dataId);\n }\n\n numDataIds():
number {\n return this.dataIdsCount;\n }\n}\n\nexport interface DataMover {\n /**\n * To be called by
backends whenever they see a dataId that they don't own.\n * Upon calling this method, the mover will fetch the
tensor from another\n * backend and register it with the current active backend.\n */\n moveData(backend:
KernelBackend, dataId: DataId): void;\n}\n\nexport interface BackendTimer {\n
// check if backend timer is available\n timerAvailable(): boolean;\n time(f: () => void):
Promise<BackendTimingInfo>;\n}\n\n/**\n * The interface that defines the kernels that should be implemented
when\n * adding a new backend. New backends don't need to implement every one of the\n * methods, this can be
done gradually (throw an error for unimplemented\n * methods).\n */\nexport class KernelBackend implements
TensorStorage, Backend, BackendTimer {\n refCount(dataId: DataId): number {\n return
notYetImplemented('refCount');\n }\n incRef(dataId: DataId): void {\n return notYetImplemented('incRef');\n
}\n timerAvailable(): boolean {\n return true;\n }\n time(f: () => void): Promise<BackendTimingInfo> {\n
return notYetImplemented('time');\n }\n read(dataId: object): Promise<BackendValues> {\n return
notYetImplemented('read');\n }\n readSync(dataId: object): BackendValues {\n return
notYetImplemented('readSync');\n }\n numDataIds(): number {\n return notYetImplemented('numDataIds');\n
}\n disposeData(dataId: object, force?: boolean): boolean {\n return notYetImplemented('disposeData');\n }\n
write(values: BackendValues, shape: number[], dtype: DataType): DataId {\n return
notYetImplemented('write');\n }\n move(\n dataId: DataId, values: BackendValues, shape: number[], dtype:
DataType,\n refCount: number): void {\n return notYetImplemented('move');\n }\n memory(): {unreliable:
boolean; reasons?: string[]} {\n return notYetImplemented('memory');\n }\n /** Returns the highest precision for
floats in bits (e.g. 16 or 32) *\n floatPrecision(): 16|32 {\n return notYetImplemented('floatPrecision');\n }\n
/** Returns the smallest representable number. *\n epsilon(): number {\n return this.floatPrecision() === 32 ?
EPSILON_FLOAT32 : EPSILON_FLOAT16;\n }\n dispose(): void {\n return notYetImplemented('dispose');\n
}\n}\n\nfunction notYetImplemented(kernelName: string): never {\n throw new Error(\n
`$${kernelName}` not yet implemented or not found in the registry. ` +\n `This kernel may not be supported
by the tf.js backend you have chosen`);\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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\n
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import {DataType, DataTypeMap, FlatVector, NumericDataType, RecursiveArray, TensorLike, TypedArray}
from
./types';\n\n/**\n * Shuffles the array in-place using Fisher-Yates algorithm.\n *\n * ```js\n * const a = [1, 2, 3, 4, 5];\n * tf.util.shuffle(a);\n * console.log(a);\n * ```\n *\n * @param array The array to shuffle in-place.\n *\n * @doc {heading: 'Util', namespace: 'util'}\n */\nexport function shuffle(array: any[] | Uint32Array | Int32Array | Float32Array): void {\n  let counter = array.length;\n  let temp = 0;\n  let index = 0;\n  // While there are elements in the array\n  while (counter > 0) {\n    // Pick a random index\n    index = (Math.random() * counter) | 0;\n    // Decrease counter by 1\n    counter--;\n    // And swap the last element with it\n    temp = array[counter];\n    array[counter] = array[index];\n    array[index] = temp;\n  }\n}\n\n/**\n * Shuffles two arrays in-place the same way using Fisher-Yates algorithm.\n *\n * ```js\n * const a = [1,2,3,4,5];\n * const b = [11,22,33,44,55];\n * tf.util.shuffleCombo(a, b);\n * console.log(a, b);\n * ```\n *\n * @param array The first array to shuffle in-place.\n * @param array2 The second array to shuffle in-place with the same permutation\n * as the first array.\n *\n * @doc {heading: 'Util', namespace: 'util'}\n */\nexport function shuffleCombo(array: any[] | Uint32Array | Int32Array | Float32Array, array2: any[] | Uint32Array | Int32Array | Float32Array): void {\n  if (array.length !== array2.length) {\n    throw Error(`Array sizes must match to be shuffled together` +\n      `First array length was ${array.length}` +\n      `Second array length was ${array2.length}`);\n  }\n  let counter = array.length;\n  let temp, temp2;\n  let index = 0;\n  // While there are elements in the array\n  while (counter > 0) {\n    // Pick a random index\n    index = (Math.random() * counter) | 0;\n    // Decrease counter by 1\n    counter--;\n    // And swap the last element of each array with it\n    temp = array[counter];\n    temp2 = array2[counter];\n    array[counter] = array[index];\n    array2[counter] = array2[index];\n    array[index] = temp;\n    array2[index] = temp2;\n  }\n}\n\n/**\n * Clamps a value to a specified range.\n */\nexport function clamp(min: number, x: number, max: number): number {\n  return Math.max(min, Math.min(x, max));\n}\n\nexport function nearestLargerEven(val: number): number {\n  return val % 2 === 0 ? val : val + 1;\n}\n\nexport function sum(arr: number[]): number {\n  let sum = 0;\n  for (let i = 0; i < arr.length; i++) {\n    sum += arr[i];\n  }\n  return sum;\n}\n\n/**\n * Returns a sample from a uniform [a, b) distribution.\n *\n * @param a The minimum support (inclusive).\n * @param b The maximum support (exclusive).\n * @return A pseudorandom number on the half-open interval [a,b).\n */\nexport function randUniform(a: number, b: number) {\n  const r = Math.random();\n  return (b * r) + (1 - r) * a;\n}\n\n/**\n * Returns the squared Euclidean distance between two vectors.\n */\nexport function distSquared(a: FlatVector, b: FlatVector): number {\n  let result = 0;\n  for (let i = 0; i < a.length; i++) {\n    const diff = Number(a[i]) - Number(b[i]);\n    result += diff * diff;\n  }\n  return result;\n}\n\n/**\n * Asserts that the expression is true. Otherwise throws an error with the\n * provided message.\n *\n * ```js\n * const x = 2;\n * tf.util.assert(x === 2, 'x is not 2');\n * ```\n *\n * @param expr The expression to assert (as a boolean).\n * @param msg A function that returns the message to report when throwing an\n * error. We use a function for performance reasons.\n *\n * @doc {heading: 'Util', namespace: 'util'}\n */\nexport function assert(expr: boolean, msg: () => string) {\n  if (!expr) {\n    throw new Error(typeof msg === 'string' ? msg : msg());\n  }\n}\n\nexport function assertShapesMatch(shapeA: number[], shapeB: number[], errorMessagePrefix = ""): void {\n  assert(\n    arraysEqual(shapeA, shapeB),\n    () => errorMessagePrefix + ` Shapes ${shapeA} and ${shapeB} must match`);\n}\n\nexport function assertNonNull(a: TensorLike): void {\n  assert(\n    a != null,\n    () => `The input to the tensor constructor must be a non-null value.`);\n}\n\n// NOTE: We explicitly type out what T extends instead of any so that\n// util.flatten on a nested array of number doesn't try to infer T as a\n// number[][], causing us to explicitly type util.flatten<number>().\n\n/**\n * Flattens an arbitrarily nested array.\n *\n * ```js\n * const a = [[1, 2], [3, 4], [5, [6, [7]]]];\n * const flat = tf.util.flatten(a);\n * console.log(flat);\n * ```\n *\n * @param arr The nested array to flatten.\n * @param result The destination array which holds the elements.\n * @param skipTypedArray If true, avoids flattening the typed arrays. Defaults\n * to false.\n *\n * @doc {heading: 'Util', namespace: 'util'}\n */\nexport function flatten<T extends number|boolean|string|Promise<number>|TypedArray>(\n

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arr: T[]RecursiveArray<T>, result: T[] = [], skipTypedArray = false): T[] {\n
  if (result == null) {\n    result = [];\n  }\n
  if (Array.isArray(arr) || isTypedArray(arr) && !skipTypedArray) {\n
    for (let i = 0; i < arr.length; ++i) {\n
      flatten(arr[i], result, skipTypedArray);\n    }\n  } else {\n
    result.push(arr as T);\n  }\n
  return result;\n}\n\n/**\n * Returns the size (number of elements) of the tensor given its shape.\n * @param shape The shape of the tensor, e.g. [3, 4, 2].\n * @return size The size of the tensor.\n */\nexport function sizeFromShape(shape: number[]): number {\n
  if (shape.length === 0) {\n    // Scalar.\n    return 1;\n  }\n
  let size = shape[0];\n
  for (let i = 1; i < shape.length; i++) {\n
    size *= shape[i];\n  }\n
  return size;\n}\n\nexport function isScalarShape(shape: number[]): boolean {\n
  return shape.length === 0;\n}\n\nexport function\n
arraysEqual(n1: FlatVector, n2: FlatVector) {\n
  if (n1 === n2) {\n    return true;\n  }\n
  if (n1 == null || n2 == null) {\n
    return false;\n  }\n
  if (n1.length !== n2.length) {\n
    return false;\n  }\n
  for (let i = 0; i < n1.length; i++) {\n
    if (n1[i] !== n2[i]) {\n      return false;\n    }\n  }\n
  return true;\n}\n\nexport function isInt(a: number): boolean {\n
  return a % 1 === 0;\n}\n\nexport function tanh(x: number): number {\n
  // tslint:disable-next-line:no-any\n
  if ((Math as any).tanh != null) {\n    // tslint:disable-next-line:no-any\n
    return (Math as any).tanh(x);\n  }\n
  if (x === Infinity) {\n
    return 1;\n  }\n
  if (x === -Infinity) {\n
    return -1;\n  }\n
  const e2x = Math.exp(2 * x);\n
  return (e2x - 1) / (e2x + 1);\n}\n}\n\nexport function sizeToSquarishShape(size: number): [number, number] {\n
  const width = Math.ceil(Math.sqrt(size));\n
  return [width, Math.ceil(size / width)];\n}\n\n/**\n * Creates a new array with randomized indicies to a given quantity.\n * @param quantity The quantity of randomized indicies to create.\n * @return randomTen A Uint32Array of randomized indicies.\n */\nexport function createShuffledIndicies(quantity: number): Uint32Array {\n
  const shuffledIndicies = new Uint32Array(quantity);\n
  for (let i = 0; i < quantity; ++i) {\n
    shuffledIndicies[i] = i;\n  }\n
  shuffle(shuffledIndicies);\n
  return shuffledIndicies;\n}\n\nexport function rightPad(a: string, size: number): string {\n
  if (size <= a.length) {\n
    return a;\n  }\n
  return a + ''.repeat(size - a.length);\n}\n\nexport function repeatedTry(\n
  checkFn: () => boolean, delayFn: (counter: number) => 0, maxCounter?: number): Promise<void> {\n
  return new Promise<void>((resolve, reject) => {\n
    let tryCount = 0;\n
    const tryFn = () => {\n
      if (checkFn()) {\n
        resolve();\n
        return;\n
      }\n
      tryCount++;\n
      const nextBackoff = delayFn(tryCount);\n
      if (maxCounter != null && tryCount >= maxCounter) {\n
        reject();\n
        return;\n
      }\n
      setTimeout(tryFn, nextBackoff);\n
    }; \n
    tryFn();\n
  });\n}\n\n/**\n * Given the full size of the array and a shape that may contain -1 as the\n * implicit dimension, returns the inferred shape where -1 is replaced.\n * E.g. For shape=[2, -1, 3] and size=24, it will return [2, 4, 3].\n * @param shape The shape, which may contain -1 in some dimension.\n * @param size The full size (number of elements) of the array.\n * @return The inferred shape where -1 is replaced with the inferred size.\n */\nexport function inferFromImplicitShape(\n
  shape: number[], size: number): number[] {\n
  let shapeProd = 1;\n
  let implicitIdx = -1;\n
  for (let i = 0; i < shape.length; ++i) {\n
    if (shape[i] >= 0) {\n
      shapeProd *= shape[i];\n
    } else if (shape[i] === -1) {\n
      if (implicitIdx !== -1) {\n
        throw Error(\n
          `Shapes can only have 1 implicit size. ` +\n
          `Found -1 at dim ${implicitIdx} and dim ${i}`);\n
      }\n
      implicitIdx = i;\n
    } else if (shape[i] < 0) {\n
      throw Error(`Shapes can not be < 0. Found ${shape[i]} at dim\n
        ${i}`);\n
    }\n
  }\n
  if (implicitIdx === -1) {\n
    if (size > 0 && size !== shapeProd) {\n
      throw Error(`Size(${size}) must match the product of shape ${shape}`);\n
    }\n
    return shape;\n
  }\n
  if (shapeProd === 0) {\n
    throw Error(\n
      `Cannot infer the missing size in [${shape}] when ` +\n
      `there are 0 elements`);\n
  }\n
  if (size % shapeProd !== 0) {\n
    throw Error(\n
      `The implicit shape can't be a fractional number. ` +\n
      `Got ${size} / ${shapeProd}`);\n
  }\n
  const newShape = shape.slice();\n
  newShape[implicitIdx] = size / shapeProd;\n
  return newShape;\n}\n\nexport function parseAxisParam(\n
  axis: number|number[], shape: number[]): number[] {\n
  const rank = shape.length;\n
  // Normalize input\n
  axis = axis == null ? shape.map((s, i) => i) : [].concat(axis);\n
  // Check for valid range\n
  assert(\n
    axis.every(ax => ax >= -rank && ax < rank),\n
    () => `All values in axis param must be in range [-\n
    ${rank}, ${rank}] but ` +\n
    `got axis ${axis}`);\n
  // Check for only integers\n
  assert(\n
    axis.every(ax =>

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isInt(ax)),\n    () => `All values in axis param must be integers but ` +\n        `got axis ${axis}`);\n\n // Handle
negative axis.\n    return axis.map(a => a < 0 ? rank + a : a);\n}\n\n/** Reduces the shape by removing all dimensions
of shape 1. */\n\nexport function squeezeShape(shape: number[], axis?: number[]):\n    { newShape: number[],
keptDims: number[] } {\n    const newShape: number[] = [];\n    const keptDims: number[] = [];\n    const isEmptyArray
= axis != null && Array.isArray(axis) && axis.length === 0;\n    const axes = (axis == null || isEmptyArray) ?\n    null :\n    parseAxisParam(axis, shape).sort();\n    let j = 0;\n    for (let
i = 0; i < shape.length; ++i) {\n        if (axes != null) {\n            if (axes[j] === i && shape[i] !== 1) {\n                throw new
Error(\n                    `Can't squeeze axis ${i} since its dim '${shape[i]}' is not 1`);\n            }\n            if ((axes[j] == null || axes[j]
> i) && shape[i] === 1) {\n                newShape.push(shape[i]);\n                keptDims.push(i);\n            }\n            if (axes[j] <= i) {\n
                j++;\n            }\n        }\n        if (shape[i] !== 1) {\n            newShape.push(shape[i]);\n            keptDims.push(i);\n        }\n    }\n    return { newShape, keptDims };\n}\n\nexport function getTypedArrayFromDType<D extends NumericDataType>(\n
    dtype: D, size: number): DataTypeMap[D] {\n    let values = null;\n    if (dtype == null || dtype === 'float32') {\n        values = new Float32Array(size);\n    } else if (dtype === 'int32') {\n        values = new Int32Array(size);\n    } else if
(dtype === 'bool') {\n        values = new Uint8Array(size);\n    } else {\n        throw new Error(`Unknown data type
${dtype}`);\n    }\n    return values as DataTypeMap[D];\n}\n\nexport
function getArrayFromDType<D extends DataType>(\n    dtype: D, size: number): DataTypeMap[D] {\n    let values
= null;\n    if (dtype == null || dtype === 'float32') {\n        values = new Float32Array(size);\n    } else if (dtype ===
'int32') {\n        values = new Int32Array(size);\n    } else if (dtype === 'bool') {\n        values = new Uint8Array(size);\n    }
else if (dtype === 'string') {\n        values = new Array<'string'>(size);\n    } else {\n        throw new Error(`Unknown data
type ${dtype}`);\n    }\n    return values as DataTypeMap[D];\n}\n\nexport function checkConversionForErrors<D
extends DataType>(\n    vals: DataTypeMap[D]|number[], dtype: D): void {\n    for (let i = 0; i < vals.length; i++) {\n        const num = vals[i] as number;\n        if (isNaN(num) || !isFinite(num)) {\n            throw Error(`A tensor of type ${dtype}
being uploaded contains ${num}.`);\n        }\n    }\n}\n\n/** Returns true if the dtype is valid. */\n\nexport function
isValidDtype(dtype: DataType): boolean {\n    return
dtype === 'bool' || dtype === 'complex64' || dtype === 'float32' ||\n        dtype === 'int32' || dtype ===
'string';\n}\n\n/**\n * Returns true if the new type can't encode the old type without loss of\n * precision.\n */\n\nexport function hasEncodingLoss(oldType: DataType, newType: DataType): boolean {\n    if (newType ===
'complex64') {\n        return false;\n    }\n    if (newType === 'float32' && oldType !== 'complex64') {\n        return false;\n    }\n    if
(newType === 'int32' && oldType !== 'float32' && oldType !== 'complex64') {\n        return false;\n    }\n    if
(newType === 'bool' && oldType === 'bool') {\n        return false;\n    }\n    return true;\n}\n\nexport function
isTypedArray(a: {}): a is Float32Array|Int32Array|Uint8Array {\n    return a instanceof Float32Array || a instanceof
Int32Array ||\n        a instanceof Uint8Array;\n}\n\nexport function bytesPerElement(dtype: DataType): number {\n
    if (dtype === 'float32' || dtype === 'int32') {\n        return 4;\n    } else if (dtype === 'complex64') {\n        return 8;\n    } else if (dtype === 'bool') {\n        return 1;\n    } else {\n        throw new Error(`Unknown dtype
${dtype}`);\n    }\n}\n\n/**\n * Returns the approximate number of bytes allocated in the string array - 2\n * bytes per
character. Computing the exact bytes for a native string in JS is\n * not possible since it depends on the encoding of
the html page that serves\n * the website.\n */\n\nexport function bytesFromStringArray(arr: Uint8Array[]): number
{\n    if (arr == null) {\n        return 0;\n    }\n    let bytes = 0;\n    arr.forEach(x => bytes += x.length);\n    return
bytes;\n}\n\n/** Returns true if the value is a string. */\n\nexport function isString(value: {}): value is string {\n
    return typeof value === 'string' || value instanceof String;\n}\n\nexport function isBoolean(value: {}): boolean {\n
    return typeof value === 'boolean';\n}\n\nexport function isNumber(value: {}): boolean {\n    return typeof value ===
'number';\n}\n\nexport function inferDtype(values: TensorLike): DataType {\n    if
(Array.isArray(values)) {\n        return inferDtype(values[0]);\n    }\n    if (values instanceof Float32Array) {\n        return
'float32';\n    } else if (values instanceof Int32Array || values instanceof Uint8Array) {\n        return 'int32';\n    } else if
(isNumber(values)) {\n        return 'float32';\n    } else if (isString(values)) {\n        return 'string';\n    } else if
(isBoolean(values)) {\n        return 'bool';\n    }\n    return 'float32';\n}\n\nexport function isFunction(f: Function) {\n
    return !!f && f.constructor && f.call && f.apply);\n}\n\nexport function nearestDivisor(size: number, start:
number): number {\n    for (let i = start; i < size; ++i) {\n        if (size % i === 0) {\n            return i;\n        }\n    }\n    return
}\n

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size;\n}\n\nexport function computeStrides(shape: number[]): number[] {\n  const rank = shape.length;\n  if (rank <
2) {\n    return [];\n  }\n  // Last dimension has implicit stride of 1, thus having D-1 (instead of D)\n  // strides.\n  const strides = new Array(rank - 1);\n  strides[rank
- 2] = shape[rank - 1];\n  for (let i = rank - 3; i >= 0; --i) {\n    strides[i] = strides[i + 1] * shape[i + 1];\n  }\n  return
strides;\n}\n\nfunction createNestedArray(offset: number, shape: number[], a: TypedArray) {\n  const ret = new
Array();\n  if (shape.length === 1) {\n    const d = shape[0];\n    for (let i = 0; i < d; i++) {\n      ret[i] = a[offset +
i];\n    }\n  } else {\n    const d = shape[0];\n    const rest = shape.slice(1);\n    const len = rest.reduce((acc, c) => acc
* c);\n    for (let i = 0; i < d; i++) {\n      ret[i] = createNestedArray(offset + i * len, rest, a);\n    }\n  }\n  return
ret;\n}\n\n// Provide a nested array of TypedArray in given shape.\nexport function toNestedArray(shape: number[],
a: TypedArray) {\n  if (shape.length === 0) {\n    // Scalar type should return a single number.\n    return a[0];\n  }\n  const size = shape.reduce((acc, c) => acc * c);\n  if (size === 0) {\n    // A tensor with shape zero should be turned
into empty list.\n    return
[];\n  }\n  if (size !== a.length) {\n    throw new Error(`[${shape}] does not match the input size ${a.length}.`);\n  }\n  return createNestedArray(0, shape, a);\n}\n\nexport function makeOnesTypedArray<D extends DataType>(\n
size: number, dtype: D): DataTypeMap[D] {\n  const array = makeZerosTypedArray(size, dtype);\n  for (let i = 0; i
< array.length; i++) {\n    array[i] = 1;\n  }\n  return array;\n}\n\nexport function makeZerosTypedArray<D extends
DataType>(\n  size: number, dtype: D): DataTypeMap[D] {\n  if (dtype === null || dtype === 'float32' || dtype ===
'complex64') {\n    return new Float32Array(size) as DataTypeMap[D];\n  } else if (dtype === 'int32') {\n    return
new Int32Array(size) as DataTypeMap[D];\n  } else if (dtype === 'bool') {\n    return new Uint8Array(size) as
DataTypeMap[D];\n  } else {\n    throw new Error(`Unknown data type ${dtype}`);\n  }\n}\n\n/**\n * Make nested
`TypedArray` filled with zeros.\n * @param shape The shape information for the nested
array.\n * @param dtype dtype of the array element.\n */\nexport function makeZerosNestedTypedArray<D
extends DataType>(\n  shape: number[], dtype: D) {\n  const size = shape.reduce((prev, curr) => prev * curr, 1);\n  if (dtype === null || dtype === 'float32') {\n    return toNestedArray(shape, new Float32Array(size));\n  } else if
(dtype === 'int32') {\n    return toNestedArray(shape, new Int32Array(size));\n  } else if (dtype === 'bool') {\n    return
toNestedArray(shape, new Uint8Array(size));\n  } else {\n    throw new Error(`Unknown data type
${dtype}`);\n  }\n}\n\nexport function assertNonNegativeIntegerDimensions(shape: number[]) {\n  shape.forEach(dimSize => {\n    assert(\n      Number.isInteger(dimSize) && dimSize >= 0,\n      () =>{\n        `Tensor must have a shape comprised of positive integers but got ` +\n          `shape [${shape}].`);\n      }\n    );\n  });\n}\n\n/**\n * Computes flat index for a given location (multidimensional index) in a\n *
Tensor/multidimensional
array.\n * @param locs Location in the tensor.\n * @param rank Rank of the tensor.\n * @param strides Tensor
strides.\n */\nexport function locToIndex(\n  locs: number[], rank: number, strides: number[]): number {\n  if (rank
=== 0) {\n    return 0;\n  } else if (rank === 1) {\n    return locs[0];\n  }\n  let index = locs[locs.length - 1];\n  for (let
i = 0; i < locs.length - 1; ++i) {\n    index += strides[i] * locs[i];\n  }\n  return index;\n}\n\n/**\n * Computes the
location (multidimensional index) in a tensor/multidimensional\n * array for a given flat index.\n * @param
index Index in flat array.\n * @param rank Rank of tensor.\n * @param strides Strides of tensor.\n */\nexport
function indexToLoc(\n  index: number, rank: number, strides: number[]): number[] {\n  if (rank === 0) {\n    return
[];\n  } else if (rank === 1) {\n    return [index];\n  }\n  const locs: number[] = new Array(rank);\n  for (let i =
0; i < locs.length - 1; ++i) {\n    locs[i] = Math.floor(index
/ strides[i]);\n    index -= locs[i] * strides[i];\n  }\n  locs[locs.length - 1] = index;\n  return locs;\n}\n\n/**\n * This
method asserts whether an object is a Promise instance.\n * @param object\n */\n// tslint:disable-next-line: no-
any\nexport function isPromise(object: any) {\n  // We chose to not use 'obj instanceof Promise' for two reasons:\n
// 1. It only reliably works for es6 Promise, not other Promise\n // implementations.\n // 2. It doesn't work with
framework that uses zone.js. zone.js monkey patch\n // the async calls, so it is possible the obj (patched) is
comparing to a\n // pre-patched Promise.\n  return object && object.then && typeof object.then ===
'function';\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the

```


License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {Platform} from './platforms/platform';\nimport {isPromise} from './util_base';\n\n// Expects flags from URL in the format ?tfjsflags=FLAG1:1,FLAG2:true.\nconst TENSORFLOWJS_FLAGS_PREFIX = 'tfjsflags';\n\ntype FlagValue = number|boolean;\ntype FlagEvaluationFn = (() => FlagValue)|(() => Promise<FlagValue>);\nexport type Flags = {\n  [featureName: string]: FlagValue\n};\nexport type FlagRegistryEntry = {\n  evaluationFn: FlagEvaluationFn;\n  setHook?: (value: FlagValue) => void;\n};\n\n/**\n * The environment contains evaluated flags as well as the registered\n * platform.\n * This is always used as a global singleton and can be retrieved with\n * `tf.env()`. \n * @doc {heading: 'Environment'}\n */\nexport class Environment {\n  private flags: Flags = {};\n  private flagRegistry: {[flagName: string]: FlagRegistryEntry} = {};\n\n  private urlFlags: Flags = {};\n\n  platformName: string;\n  platform: Platform;\n\n  // tslint:disable-next-line: no-any\n  constructor(public global: any) {\n    this.populateURLFlags();\n  }\n\n  setPlatform(platformName: string, platform: Platform) {\n    if (this.platform != null) {\n      console.warn(`Platform ${this.platformName} has already been set. `);\n      `Overwriting the platform with ${platform}.`);\n    }\n    this.platformName = platformName;\n    this.platform = platform;\n  }\n\n  registerFlag(flagName: string, evaluationFn: FlagEvaluationFn, setHook?: (value: FlagValue) => void) {\n    this.flagRegistry[flagName] = {evaluationFn, setHook};\n\n    // Override the flag value from the URL. This has to happen here because the\n    // environment is initialized before flags get registered.\n    if (this.urlFlags[flagName] != null) {\n      const flagValue = this.urlFlags[flagName];\n      console.warn(`Setting feature override from URL ${flagName}: ${flagValue}.`);\n      this.set(flagName, flagValue);\n    }\n  }\n\n  async getAsync(flagName: string): Promise<FlagValue> {\n    if (flagName in this.flags) {\n      return this.flags[flagName];\n    }\n\n    this.flags[flagName] = await this.evaluateFlag(flagName);\n    return this.flags[flagName];\n  }\n\n  get(flagName: string): FlagValue {\n    if (flagName in this.flags) {\n      return this.flags[flagName];\n    }\n\n    const flagValue = this.evaluateFlag(flagName);\n    if (isPromise(flagValue)) {\n      throw new Error(`Flag ${flagName} cannot be synchronously evaluated. `);\n      `Please use getAsync() instead.`);\n    }\n\n    this.flags[flagName] = flagValue\n\n    as number | boolean;\n\n    return this.flags[flagName];\n  }\n\n  getNumber(flagName: string): number {\n    return this.get(flagName) as number;\n  }\n\n  getBool(flagName: string): boolean {\n    return this.get(flagName) as boolean;\n  }\n\n  getFlags(): Flags {\n    return this.flags;\n  }\n\n  // For backwards compatibility.\n  get features(): Flags {\n    return this.flags;\n  }\n\n  set(flagName: string, value: FlagValue): void {\n    if (this.flagRegistry[flagName] == null) {\n      throw new Error(`Cannot set flag ${flagName} as it has not been registered.`);\n    }\n\n    this.flags[flagName] = value;\n    if (this.flagRegistry[flagName].setHook != null) {\n      this.flagRegistry[flagName].setHook(value);\n    }\n  }\n\n  private evaluateFlag(flagName: string): FlagValue|Promise<FlagValue> {\n    if (this.flagRegistry[flagName] == null) {\n      throw new Error(`Cannot evaluate flag '${flagName}': no evaluation function found.`);\n    }\n\n    return this.flagRegistry[flagName].evaluationFn();\n  }\n\n  setFlags(flags: Flags) {\n    this.flags = Object.assign({}, flags);\n  }\n\n  reset() {\n    this.flags = {};\n    this.urlFlags = {};\n    this.populateURLFlags();\n  }\n\n  private populateURLFlags(): void {\n    if (typeof this.global === 'undefined' ||\n      typeof this.global.location === 'undefined' ||\n      typeof this.global.location.search === 'undefined') {\n      return;\n    }\n\n    const urlParams = getQueryParams(this.global.location.search);\n    if (TENSORFLOWJS_FLAGS_PREFIX in urlParams) {\n      const keyValues = urlParams[TENSORFLOWJS_FLAGS_PREFIX].split(',');\n      keyValues.forEach(keyValue => {\n        const [key, value] = keyValue.split(':') as [string, string];\n        this.urlFlags[key] = parseValue(key, value);\n      });\n    }\n  }\n\n  export function getQueryParams(queryString: string): {[key: string]: string} {\n
```

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const params = {};
queryString.replace(/[\?&]{([\^=?&]+)(?=:([\^&]*))/?/g, (s, ...t)
=> {\n  decodeParam(params, t[0], t[1]);\n  return t.join('=');\n });\n return params;\n}\n\nfunction
decodeParam(\n  params: {[key: string]: string}, name: string, value?: string) {\n
params[decodeURIComponent(name)] = decodeURIComponent(value || '');\n}\n\nfunction parseValue(flagName:
string, value: string): FlagValue {\n  value = value.toLowerCase();\n  if (value === 'true' || value === 'false') {\n
return value === 'true';\n  } else if (`${+value}` === value) {\n    return +value;\n  }\n  throw new Error(\n
`Could not parse value flag value ${value} for flag ${flagName}.`);\n}\n\n/**\n * Returns the current environment
(a global singleton).\n *\n * The environment object contains the evaluated feature values as well as the\n * active
platform.\n *\n * @doc {heading: 'Environment'}\n */\nexport function env() {\n  return ENV;\n}\n\nexport let
ENV: Environment = null;\nexport function setEnvironmentGlobal(environment: Environment) {\n  ENV =
environment;\n}\n\n", "//
  shim for using process in browser\nvar process = module.exports = {};\n\n// cached from whatever global is present
so that test runners that stub it\n// don't break things. But we need to wrap it in a try catch in case it is\n// wrapped in
strict mode code which doesn't define any globals. It's inside a\n// function because try/catches deoptimize in certain
engines.\n\nvar cachedSetTimeout;\nvar cachedClearTimeout;\n\nfunction defaultSetTimeout() {\n  throw new
Error('setTimeout has not been defined');\n}\n\nfunction defaultClearTimeout () {\n  throw new Error('clearTimeout
has not been defined');\n}\n\n(function () {\n  try {\n    if (typeof setTimeout === 'function') {\n
cachedSetTimeout = setTimeout;\n    } else {\n      cachedSetTimeout = defaultSetTimeout;\n    } \n  } catch
(e) {\n    cachedSetTimeout = defaultSetTimeout;\n  }\n  try {\n    if (typeof clearTimeout === 'function') {\n
cachedClearTimeout = clearTimeout;\n    } else {\n      cachedClearTimeout = defaultClearTimeout;\n    } \n  } catch (e) {\n
cachedClearTimeout = defaultClearTimeout;\n  }\n})\n\nfunction runTimeout(fun) {\n  if (cachedSetTimeout
=== setTimeout) {\n    //normal enviroments in sane situations\n    return setTimeout(fun, 0);\n  }\n  // if
setTimeout wasn't available but was latter defined\n  if ((cachedSetTimeout === defaultSetTimeout ||
!cachedSetTimeout) && setTimeout) {\n    cachedSetTimeout = setTimeout;\n    return setTimeout(fun, 0);\n
}\n  try {\n    // when when somebody has screwed with setTimeout but no I.E. maddness\n    return
cachedSetTimeout(fun, 0);\n  } catch(e){\n    try {\n      // When we are in I.E. but the script has been eveled
so I.E. doesn't trust the global object when called normally\n      return cachedSetTimeout.call(null, fun, 0);\n
    } catch(e){\n      // same as above but when it's a version of I.E. that must
have the global object for 'this', hopfully our context correct otherwise it will throw a global error\n      return
cachedSetTimeout.call(this, fun, 0);\n    } \n  }\n}\n\nfunction runClearTimeout(marker) {\n  if
(cachedClearTimeout === clearTimeout) {\n    //normal enviroments in sane situations\n    return
clearTimeout(marker);\n  }\n  // if clearTimeout wasn't available but was latter defined\n  if
((cachedClearTimeout === defaultClearTimeout || !cachedClearTimeout) && clearTimeout) {\n
cachedClearTimeout = clearTimeout;\n    return clearTimeout(marker);\n  }\n  try {\n    // when when
somebody has screwed with setTimeout but no I.E. maddness\n    return cachedClearTimeout(marker);\n  }
catch (e){\n    try {\n      // When we are in I.E. but the script has been eveled so I.E. doesn't trust the global
object when called normally\n      return cachedClearTimeout.call(null, marker);\n    } catch (e){\n
      // same as above but when it's a version of I.E. that must have the global object for 'this', hopfully our context
correct otherwise it will throw a global error.\n      // Some versions of I.E. have different rules for clearTimeout
vs setTimeout\n      return cachedClearTimeout.call(this, marker);\n    } \n  }\n}\n\n\n\n\n\nvar queue = [];\nvar
draining = false;\nvar currentQueue;\nvar queueIndex = -1;\n\nfunction cleanUpNextTick() {\n  if (!draining ||
!currentQueue) {\n    return;\n  }\n  draining = false;\n  if (currentQueue.length) {\n    queue =
currentQueue.concat(queue);\n  } else {\n    queueIndex = -1;\n  }\n  if (queue.length) {\n    drainQueue();\n
}\n}\n\nfunction drainQueue() {\n  if (draining) {\n    return;\n  }\n  var timeout =
runTimeout(cleanUpNextTick);\n  draining = true;\n  var len = queue.length;\n  while(len) {\n
currentQueue = queue;\n    queue = [];\n    while (++queueIndex <

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len) {\n    if (currentQueue) {\n        currentQueue[queueIndex].run();\n    }\n}\n
queueIndex = -1;\n len = queue.length;\n }\n currentQueue = null;\n draining = false;\n
runClearTimeout(timeout);\n\n\nprocess.nextTick = function (fun) {\n    var args = new Array(arguments.length -
1);\n if (arguments.length > 1) {\n    for (var i = 1; i < arguments.length; i++) {\n        args[i - 1] =
arguments[i];\n    }\n }\n queue.push(new Item(fun, args));\n if (queue.length === 1 && !draining) {\n
runTimeout(drainQueue);\n }\n};\n\n// v8 likes predictable objects\nfunction Item(fun, array) {\n    this.fun =
fun;\n    this.array = array;\n}\n\nItem.prototype.run = function () {\n    this.fun.apply(null,
this.array);\n};\n\nprocess.title = 'browser';\nprocess.browser = true;\nprocess.env = {};\nprocess.argv =
[];\nprocess.version = ''; // empty string to avoid regexp issues\nprocess.versions = {};\n\nfunction
noop() {}\n\nprocess.on = noop;\nprocess.addListener = noop;\nprocess.once = noop;\nprocess.off =
noop;\nprocess.removeListener = noop;\nprocess.removeAllListeners = noop;\nprocess.emit =
noop;\nprocess.prependListener = noop;\nprocess.prependOnceListener = noop;\n\nprocess.listeners = function
(name) { return [] }\n\nprocess.binding = function (name) {\n    throw new Error('process.binding is not
supported');\n};\n\nprocess.cwd = function () { return '/' }\nprocess.chdir = function (dir) {\n    throw new
Error('process.chdir is not supported');\n};\n\nprocess.umask = function() { return 0; };\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed
under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*\n\n// Note that the identifier globalNameSpace is scoped to this module, but will\n\n// always resolve to the same
global object regardless of how the module is\n\n// resolved.\n\n// tslint:disable-next-line:no-any\nlet globalNameSpace:
{}_tfGlobals: Map<string, any>};\n\n// tslint:disable-next-line:no-any\nexport function getGlobalNamespaces():
{}_tfGlobals: Map<string, any>} {\n    if (globalNameSpace == null) {\n        // tslint:disable-next-line:no-any\n        let ns:
any;\n        if (typeof (window) !== 'undefined') {\n            ns = window;\n        } else if (typeof (global) !== 'undefined') {\n
            ns = global;\n        } else if (typeof (process) !== 'undefined') {\n            ns = process;\n        }
else if (typeof (self) !== 'undefined') {\n            ns = self;\n        } else {\n            throw new Error('Could not find a global
object');\n        }\n        globalNameSpace = ns;\n    }\n    return globalNameSpace;\n}\n\n// tslint:disable-next-line:no-
any\nfunction getGlobalMap(): Map<string, any> {\n    const ns = getGlobalNamespaces();\n    if (ns._tfGlobals ==
null) {\n        ns._tfGlobals = new Map();\n    }\n    return ns._tfGlobals;\n}\n\n/**\n * Returns a globally accessible
'singleton' object.\n * \n * @param key the name of the object\n * @param init a function to initialize to initialize
this object\n * \n * the first time it is fetched.\n */\n\nexport function getGlobal<T>(key: string, init: () => T): T {\n
const globalMap = getGlobalMap();\n    if (globalMap.has(key)) {\n        return globalMap.get(key);\n    } else {\n
const singleton = init();\n        globalMap.set(key, singleton);\n        return globalMap.get(key);\n    }\n}\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n *
you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\n//\n\nAllow UpperCamelCase variable names\n\n// tslint:disable: variable-name\n\n// Unfortunately just enabling PascalCase
per file (tslint.enable:\n\n// allow-pascal-case) doesn't work.\n\nimport {NamedTensorInfoMap, TensorInfo} from
'./kernel_registry';\nimport {ExplicitPadding} from './ops/conv_util';\nimport {Activation} from

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./ops/fused_types';\nimport
{DataType, PixelData} from './types';\n\nexport const Abs = 'Abs';\nexport type AbsInputs =
UnaryInputs;\n\nexport const Acos = 'Acos';\nexport type AcosInputs = UnaryInputs;\n\nexport const Acosh =
'Acosh';\nexport type AcoshInputs = UnaryInputs;\n\nexport const Add = 'Add';\nexport type AddInputs =
BinaryInputs;\n\nexport const AddN = 'AddN';\nexport type AddNInputs = TensorInfo[];\n\nexport const All =
'All';\nexport type AllInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface AllAttrs {\n  axis:
number|number[];\n  keepDims: boolean;\n}\n\nexport const Any = 'Any';\nexport type AnyInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface AnyAttrs {\n  axis: number|number[];\n  keepDims:
boolean;\n}\n\nexport const ArgMax = 'ArgMax';\nexport type ArgMaxInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface ArgMaxAttrs {\n  axis: number;\n}\n\nexport const ArgMin = 'ArgMin';\nexport type
ArgMinInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface ArgMinAttrs {\n  axis:
number;\n}\n\nexport const Asin = 'Asin';\nexport type AsinInputs = UnaryInputs;\n\nexport const Asinh =
'Asinh';\nexport type AsinhInputs = UnaryInputs;\n\nexport const Atan = 'Atan';\nexport type AtanInputs =
UnaryInputs;\n\nexport const Atanh = 'Atanh';\nexport type AtanhInputs = UnaryInputs;\n\nexport const Atan2 =
'Atan2';\nexport type Atan2Inputs = BinaryInputs;\n\nexport const AvgPool = 'AvgPool';\nexport type
AvgPoolInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface AvgPoolAttrs {\n  filterSize: [number,
number]|number;\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const AvgPoolGrad = 'AvgPoolGrad';\nexport type AvgPoolGradInputs =
Pick<NamedTensorInfoMap, 'dy'|'input'>;\nexport interface AvgPoolGradAttrs {\n  filterSize: [number,
number]|number;\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n}\n\nexport const AvgPool3D =
'AvgPool3D';\nexport type AvgPool3DInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface AvgPool3DAttrs {\n  filterSize: [number, number, number]|number;\n  strides: [number,
number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  dataFormat:
'NDHWC'|'NCDHW';\n}\n\nexport const AvgPool3DGrad = 'AvgPool3DGrad';\nexport type
AvgPool3DGradInputs = Pick<NamedTensorInfoMap, 'dy'|'input'>;\nexport interface AvgPool3DGradAttrs {\n
filterSize: [number, number, number]|number;\n  strides: [number, number, number]|number;\n  pad:
'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const BatchMatMul =
'BatchMatMul';\nexport type BatchMatMulInputs = Pick<NamedTensorInfoMap, 'a'|'b'>;\nexport interface
BatchMatMulAttrs {\n  transposeA: boolean;\n  transposeB: boolean;\n}\n\nexport const BatchToSpaceND =
'BatchToSpaceND';\nexport type BatchToSpaceNDInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface
BatchToSpaceNDAttrs {\n  blockShape: number[];\n  crops: number[][];\n}\n\nexport
type BinaryInputs = Pick<NamedTensorInfoMap, 'a'|'b'>;\n\nexport const Bincount = 'Bincount';\nexport type
BincountInputs = Pick<NamedTensorInfoMap, 'x'|'weights'>;\nexport interface BincountAttrs {\n  size:
number;\n}\n\nexport const BroadcastTo = 'BroadcastTo';\nexport type BroadcastToInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface BroadCastToAttrs {\n  shape: number[];\n  inputShape:
number[]; // for gradient\n}\n\nexport const Cast = 'Cast';\nexport type CastInputs = UnaryInputs;\nexport interface
CastAttrs {\n  dtype: DataType;\n}\n\nexport const Ceil = 'Ceil';\nexport type CeilInputs = UnaryInputs;\n\nexport
const ClipByValue = 'ClipByValue';\nexport type ClipByValueInputs = UnaryInputs;\nexport interface
ClipByValueAttrs {\n  clipValueMin: number;\n  clipValueMax: number;\n}\n\nexport const Complex =
'Complex';\nexport type ComplexInputs = Pick<NamedTensorInfoMap, 'real'|'imag'>;\n\nexport const ComplexAbs =
'ComplexAbs';\nexport type ComplexAbsInputs
= UnaryInputs;\n\nexport const Concat = 'Concat';\nexport type ConcatInputs = TensorInfo[];\nexport interface
ConcatAttrs {\n  axis: number;\n}\n\nexport const Conv2D = 'Conv2D';\nexport type Conv2DInputs =
Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Conv2DAttrs {\n  strides: [number, number]|number;\n
pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number,
number]|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const Conv2DBackpropFilter =
'Conv2DBackpropFilter';\nexport type Conv2DBackpropFilterInputs = Pick<NamedTensorInfoMap,
'x'|'dy'>;\nexport interface Conv2DBackpropFilterAttrs {\n  strides: [number, number]|number;\n  pad:

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'valid'|'same'|number|ExplicitPadding;\n dataFormat: 'NHWC'|'NCHW';\n dimRoundingMode?:
'floor'|'round'|'ceil';\n filterShape: [number, number, number, number];\n}\n\nexport const Conv2DBackpropInput =
'Conv2DBackpropInput';\nexport type Conv2DBackpropInputInputs = Pick<NamedTensorInfoMap,
'dy'|'filter'>;\nexport interface Conv2DBackpropInputAttrs {\n strides: [number, number]|number;\n pad:
'valid'|'same'|number|ExplicitPadding;\n dataFormat: 'NHWC'|'NCHW';\n dimRoundingMode?:
'floor'|'round'|'ceil';\n inputShape: [number, number, number, number];\n}\n\nexport const Conv3D =
'Conv3D';\nexport type Conv3DInputs = Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Conv3DAttrs
{\n strides: [number, number, number]|number;\n pad: 'valid'|'same';\n dataFormat: 'NDHWC'|'NCDHW';\n
dilations: [number, number, number]|number;\n}\n\nexport const Conv3DBackpropFilterV2 =
'Conv3DBackpropFilterV2';\nexport type Conv3DBackpropFilterV2Inputs = Pick<NamedTensorInfoMap,
'x'|'dy'>;\n\nexport interface Conv3DBackpropFilterV2Attrs {\n strides: [number, number, number]|number;\n pad:
'valid'|'same';\n filterShape: [number, number, number, number, number];\n}\n\nexport const
Conv3DBackpropInputV2 = 'Conv3DBackpropInputV2';\nexport type Conv3DBackpropInputV2Inputs
=\n Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface Conv3DBackpropInputV2Attrs {\n strides:
[number, number, number]|number;\n pad: 'valid'|'same';\n inputShape: [number, number, number, number,
number];\n}\n\nexport const Cos = 'Cos';\nexport type CosInputs = UnaryInputs;\n\nexport const Cosh =
'Cosh';\nexport type CoshInputs = UnaryInputs;\n\nexport const Cumsum = 'Cumsum';\nexport type CumsumInputs
= Pick<NamedTensorInfoMap, 'x'>;\nexport interface CumsumAttrs {\n axis: number;\n exclusive: boolean;\n
reverse: boolean;\n}\n\nexport const CropAndResize = 'CropAndResize';\nexport type CropAndResizeInputs =\n
Pick<NamedTensorInfoMap, 'image'|'boxes'|'boxInd'>;\nexport interface CropAndResizeAttrs {\n cropSize:
[number, number];\n method: 'bilinear'|'nearest';\n extrapolationValue: number;\n}\n\nexport const DenseBincount
= 'DenseBincount';\nexport type DenseBincountInputs = Pick<NamedTensorInfoMap, 'x'|'weights'>;\nexport
interface DenseBincountAttrs {\n size:
number;\n binaryOutput?: boolean;\n}\n\nexport const DepthToSpace = 'DepthToSpace';\nexport type
DepthToSpaceInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface DepthToSpaceAttrs {\n blockSize:
number;\n dataFormat: 'NHWC'|'NCHW';\n}\n\nexport const DepthwiseConv2dNative =
'DepthwiseConv2dNative';\nexport type DepthwiseConv2dNativeInputs =\n Pick<NamedTensorInfoMap,
'x'|'filter'>;\nexport interface DepthwiseConv2dNativeAttrs {\n strides: [number, number]|number;\n pad:
'valid'|'same'|number;\n dataFormat: 'NHWC'|'NCHW';\n dilations: [number, number]|number;\n
dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const DepthwiseConv2dNativeBackpropFilter =\n
'DepthwiseConv2dNativeBackpropFilter';\nexport type DepthwiseConv2dNativeBackpropFilterInputs =\n
Pick<NamedTensorInfoMap, 'x'|'dy'>;\nexport interface DepthwiseConv2dNativeBackpropFilterAttrs {\n strides:
[number, number]|number;\n dilations: [number, number]|number;\n pad: 'valid'|'same'|number;\n
dimRoundingMode?:
'floor'|'round'|'ceil';\n filterShape: [number, number, number, number];\n}\n\nexport const
DepthwiseConv2dNativeBackpropInput =\n 'DepthwiseConv2dNativeBackpropInput';\nexport type
DepthwiseConv2dNativeBackpropInputInputs =\n Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface
DepthwiseConv2dNativeBackpropInputAttrs {\n strides: [number, number]|number;\n dilations: [number,
number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?: 'floor'|'round'|'ceil';\n inputShape: [number,
number, number, number];\n}\n\nexport const Diag = 'Diag';\nexport type DiagInputs =
Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Dilation2D = 'Dilation2D';\nexport type Dilation2DInputs =
Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Dilation2DAttrs {\n strides: [number, number]|number;\n
pad: 'valid'|'same'|number;\n dilations: [number, number]|number;\n}\n\nexport const Dilation2DBackpropInput =
'Dilation2DBackpropInput';\nexport type Dilation2DBackpropInputInputs
=\n Pick<NamedTensorInfoMap, 'x'|'filter'|'dy'>;\n\nexport const Dilation2DBackpropFilter =
'Dilation2DBackpropFilter';\nexport type Dilation2DBackpropFilterInputs =\n Pick<NamedTensorInfoMap,
'x'|'filter'|'dy'>;\n\nexport const RealDiv = 'RealDiv';\nexport type RealDivInputs = BinaryInputs;\n\nexport const
Elu = 'Elu';\nexport type EluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const EluGrad =

```



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= 'MaxPool3DGrad';\nexport type MaxPool3DGradInputs =\n  Pick<NamedTensorInfoMap,
'dy'|'input'|'output'>;\nexport interface MaxPool3DGradAttrs {\n  filterSize: [number, number, number]|number;\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPoolWithArgmax = 'MaxPoolWithArgmax';\nexport type
MaxPoolWithArgmaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPoolWithArgmaxAttrs {\n
filterSize: [number, number]|number;\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n
includeBatchInIndex: boolean;\n}\n\nexport const Mean = 'Mean';\nexport
type MeanInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MeanAttrs {\n  axis: number|number[];\n
keepDims: boolean;\n}\n\nexport const Min = 'Min';\nexport type MinInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface MinAttrs {\n  axis: number|number[];\n  keepDims: boolean;\n}\n\nexport const Minimum =
'Minimum';\nexport type MinimumInputs = BinaryInputs;\n\nexport const MirrorPad = 'MirrorPad';\nexport type
MirrorPadInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MirrorPadAttrs {\n  paddings:
Array<[number, number]>;\n  mode: 'reflect'|'symmetric';\n}\n\nexport const Mod = 'Mod';\nexport type ModInputs
= BinaryInputs;\n\nexport const Multinomial = 'Multinomial';\nexport type MultinomialInputs =
Pick<NamedTensorInfoMap, 'logits'>;\nexport interface MultinomialAttrs {\n  numSamples: number;\n  seed:
number;\n  normalized: boolean;\n}\n\nexport const Multiply = 'Multiply';\nexport type MultiplyInputs =
BinaryInputs;\n\nexport const Neg = 'Neg';\nexport type
NegInputs = UnaryInputs;\n\nexport const NotEqual = 'NotEqual';\nexport type NotEqualInputs =
BinaryInputs;\n\nexport const NonMaxSuppressionV3 = 'NonMaxSuppressionV3';\nexport type
NonMaxSuppressionV3Inputs =\n  Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface
NonMaxSuppressionV3Attrs {\n  maxOutputSize: number;\n  iouThreshold: number;\n  scoreThreshold:
number;\n}\n\nexport const NonMaxSuppressionV4 = 'NonMaxSuppressionV4';\nexport type
NonMaxSuppressionV4Inputs =\n  Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface
NonMaxSuppressionV4Attrs {\n  maxOutputSize: number;\n  iouThreshold: number;\n  scoreThreshold: number;\n
padToMaxOutputSize: boolean;\n}\n\nexport const NonMaxSuppressionV5 = 'NonMaxSuppressionV5';\nexport
type NonMaxSuppressionV5Inputs =\n  Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface
NonMaxSuppressionV5Attrs {\n  maxOutputSize: number;\n  iouThreshold: number;\n  scoreThreshold: number;\n
softNmsSigma: number;\n}\n\nexport
const OnesLike = 'OnesLike';\nexport type OnesLikeInputs = UnaryInputs;\n\nexport const OneHot =
'OneHot';\nexport type OneHotInputs = Pick<NamedTensorInfoMap, 'indices'>;\nexport interface OneHotAttrs {\n
depth: number;\n  onValue: number;\n  offValue: number;\n}\n\nexport const Pack = 'Pack';\nexport type
PackInputs = TensorInfo[];\nexport interface PackAttrs {\n  axis: number;\n}\n\nexport const PadV2 =
'PadV2';\nexport type PadV2Inputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface PadV2Attrs {\n
paddings: Array<[number, number]>;\n  constantValue: number;\n}\n\nexport const Pool = 'Pool';\nexport type
PoolInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport const Pow = 'Pow';\nexport type PowInputs =
BinaryInputs;\n\nexport const Prelu = 'Prelu';\nexport type PreluInputs = Pick<NamedTensorInfoMap,
'x'|'alpha'>;\n\nexport const Prod = 'Prod';\nexport type ProdInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface ProdAttrs {\n  axis: number|number[];\n  keepDims: boolean;\n}\n\nexport
const Range = 'Range';\nexport interface RangeAttrs {\n  start: number;\n  stop: number;\n  step: number;\n  dtype:
'float32'|'int32';\n}\n\nexport const Real = 'Real';\nexport type RealInputs = Pick<NamedTensorInfoMap,
'input'>;\n\nexport const Reciprocal = 'Reciprocal';\nexport type ReciprocalInputs = UnaryInputs;\n\nexport const
Relu = 'Relu';\nexport type ReluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Reshape =
'Reshape';\nexport type ReshapeInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface ReshapeAttrs {\n
shape: number[];\n}\n\nexport const ResizeNearestNeighbor = 'ResizeNearestNeighbor';\nexport type
ResizeNearestNeighborInputs = Pick<NamedTensorInfoMap, 'images'>;\nexport interface
ResizeNearestNeighborAttrs {\n  alignCorners: boolean;\n  halfPixelCenters: boolean;\n  size: [number,
number];\n}\n\nexport const ResizeNearestNeighborGrad = 'ResizeNearestNeighborGrad';\nexport type
ResizeNearestNeighborGradInputs =\n  Pick<NamedTensorInfoMap,

```

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'images'|dy>;\nextport type ResizeNearestNeighborGradAttrs = ResizeNearestNeighborAttrs;\nextport const
ResizeBilinear = 'ResizeBilinear';\nextport type ResizeBilinearInputs = Pick<NamedTensorInfoMap,
'images'>;\nextport interface ResizeBilinearAttrs {\n alignCorners: boolean;\n halfPixelCenters: boolean;\n size:
[number, number];\n}\nextport const ResizeBilinearGrad = 'ResizeBilinearGrad';\nextport type
ResizeBilinearGradInputs = Pick<NamedTensorInfoMap, 'images'|dy>;\nextport type ResizeBilinearGradAttrs =
ResizeBilinearAttrs;\nextport const Relu6 = 'Relu6';\nextport type Relu6Inputs = Pick<NamedTensorInfoMap,
'x'>;\nextport const Reverse = 'Reverse';\nextport type ReverseInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport
interface ReverseAttrs {\n dims: number|number[];\n}\nextport const Round = 'Round';\nextport type RoundInputs
= UnaryInputs;\nextport const Rsqrt = 'Rsqrt';\nextport type RsqrtInputs = UnaryInputs;\nextport const ScatterNd
= 'ScatterNd';\nextport type ScatterNdInputs
= Pick<NamedTensorInfoMap, 'indices'|updates>;\nextport interface ScatterNdAttrs {\n shape:
number[];\n}\nextport const Select = 'Select';\nextport type SelectInputs = Pick<NamedTensorInfoMap,
'condition'|'t'|'e'>;\nextport const Selu = 'Selu';\nextport type SeluInputs = Pick<NamedTensorInfoMap,
'x'>;\nextport const Slice = 'Slice';\nextport type SliceInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface
SliceAttrs {\n begin: number|number[];\n size: number|number[];\n}\nextport const Sin = 'Sin';\nextport type
SinInputs = UnaryInputs;\nextport const Sinh = 'Sinh';\nextport type SinhInputs = UnaryInputs;\nextport const
Sign = 'Sign';\nextport type SignInputs = UnaryInputs;\nextport const Sigmoid = 'Sigmoid';\nextport type
SigmoidInputs = UnaryInputs;\nextport const Softplus = 'Softplus';\nextport type SoftplusInputs =
UnaryInputs;\nextport const Sqrt = 'Sqrt';\nextport type SqrtInputs = UnaryInputs;\nextport const Sum =
'Sum';\nextport type SumInputs = Pick<NamedTensorInfoMap,
'x'>;\nextport interface SumAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\nextport const
SpaceToBatchND = 'SpaceToBatchND';\nextport type SpaceToBatchNDInputs = Pick<NamedTensorInfoMap,
'x'>;\nextport interface SpaceToBatchNDAttrs {\n blockShape: number[];\n paddings: number[][];\n}\nextport
const SplitV = 'SplitV';\nextport type SplitVInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface SplitVAttrs
{\n numOrSizeSplits: number[]|number;\n axis: number;\n}\nextport const Softmax = 'Softmax';\nextport type
SoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;\nextport interface SoftmaxAttrs {\n dim:
number;\n}\nextport const SquaredDifference = 'SquaredDifference';\nextport type SquaredDifferenceInputs =
BinaryInputs;\nextport const Square = 'Square';\nextport type SquareInputs = Pick<NamedTensorInfoMap,
'x'>;\nextport const Sub = 'Sub';\nextport type SubInputs = BinaryInputs;\nextport const SparseToDense =
'SparseToDense';\nextport type SparseToDenseInputs =\n
Pick<NamedTensorInfoMap, 'sparseIndices'|'sparseValues'|'defaultValue'>;\nextport interface SparseToDenseAttrs
{\n outputShape: number[];\n}\nextport const StridedSlice = 'StridedSlice';\nextport type StridedSliceInputs =
Pick<NamedTensorInfoMap, 'x'>;\nextport interface StridedSliceAttrs {\n begin: number[];\n end: number[];\n
strides: number[];\n beginMask: number;\n endMask: number;\n ellipsisMask: number;\n newAxisMask:
number;\n shrinkAxisMask: number;\n}\nextport const Tan = 'Tan';\nextport type TanInputs =
UnaryInputs;\nextport const Tanh = 'Tanh';\nextport type TanhInputs = UnaryInputs;\nextport const Tile =
'Tile';\nextport type TileInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface TileAttrs {\n reps:
number[];\n}\nextport const TopK = 'TopK';\nextport type TopKInputs = Pick<NamedTensorInfoMap,
'x'>;\nextport interface TopKAttrs {\n k: number;\n sorted: boolean;\n}\nextport const Transpose =
'Transpose';\nextport type TransposeInputs = Pick<NamedTensorInfoMap,
'x'>;\nextport interface TransposeAttrs {\n perm: number[];\n}\nextport const Unique = 'Unique';\nextport type
UniqueInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface UniqueAttrs {\n axis: number;\n}\nextport
type UnaryInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport const Unpack = 'Unpack';\nextport type
UnpackInputs = Pick<NamedTensorInfoMap, 'value'>;\nextport interface UnpackAttrs {\n axis:
number;\n}\nextport const UnsortedSegmentSum = 'UnsortedSegmentSum';\nextport type
UnsortedSegmentSumInputs =\n Pick<NamedTensorInfoMap, 'x'|'segmentIds'>;\nextport interface
UnsortedSegmentSumAttrs {\n numSegments: number;\n}\nextport const ZerosLike = 'ZerosLike';\nextport type
ZerosLikeInputs = UnaryInputs;\n\n**\n * TensorFlow.js-only kernels\n */\nextport const Step = 'Step';\nextport

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type StepInputs = UnaryInputs;\nexport interface StepAttrs {\n  alpha: number;\n}\n\nexport const FromPixels =
'FromPixels';\nexport interface FromPixelsInputs {\n  pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n
HTMLVideoElement|ImageBitmap;\n}\n\nexport interface FromPixelsAttrs {\n  numChannels:
number;\n}\n\nexport const RotateWithOffset = 'RotateWithOffset';\nexport type RotateWithOffsetInputs =
Pick<NamedTensorInfoMap, 'image'>;\nexport interface RotateWithOffsetAttrs {\n  radians: number;\n  fillValue:
number|[number, number, number];\n  center: number|[number, number];\n}\n\nexport const _FusedMatMul =
'_FusedMatMul';\n\n// tslint:disable-next-line: class-name\nexport interface _FusedMatMulInputs extends
NamedTensorInfoMap {\n  a: TensorInfo;\n  b: TensorInfo;\n  bias?: TensorInfo;\n  preluActivationWeights?:
TensorInfo;\n}\n\n// tslint:disable-next-line: class-name\nexport interface _FusedMatMulAttrs {\n  transposeA:
boolean;\n  transposeB: boolean;\n  activation: Activation;\n  leakyreluAlpha?: number;\n}\n\nexport const
FusedConv2D = 'FusedConv2D';\nexport interface FusedConv2DInputs extends NamedTensorInfoMap {\n  x:
TensorInfo;\n  filter: TensorInfo;\n
bias?: TensorInfo;\n  preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedConv2DAttrs {\n  strides:
[number, number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number, number]|number;\n  dimRoundingMode: 'floor'|'round'|'ceil';\n  activation: Activation;\n  leakyreluAlpha?: number;\n}\n\nexport const FusedDepthwiseConv2D = 'FusedDepthwiseConv2D';\nexport
interface FusedDepthwiseConv2DInputs extends NamedTensorInfoMap {\n  x: TensorInfo;\n  filter: TensorInfo;\n
bias?: TensorInfo;\n  preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedDepthwiseConv2DAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number, number]|number;\n  dimRoundingMode: 'floor'|'round'|'ceil';\n  activation: Activation;\n  leakyreluAlpha?:
number;\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {env} from './environment';\nimport {getGlobal} from './global_util';\nimport {NamedGradientMap}
from './tape';\nimport {Tensor} from './tensor';\nimport {DataType, RecursiveArray} from './types';\n\nconst
kernelRegistry =\n  getGlobal('kernelRegistry', () => new Map<string, KernelConfig>());\nconst gradRegistry =\n  getGlobal('gradRegistry', () => new Map<string,
GradConfig>());\n\nexport type DataId = object;\n\nexport type AttributeValue =\n  number|number[]|boolean|boolean[]|string|string[]|NamedAttrMap;\n\n/** These are extra non-tensor/primitive
params passed to kernel functions. */\n\nexport type Attribute =
AttributeValue|RecursiveArray<AttributeValue>;\n\n/** Specifies the code to run when executing a kernel. */\n\nexport type KernelFunc = (params: {\n  inputs: NamedTensorInfoMap,\n  backend: {},\n  attrs?:
NamedAttrMap,\n}) => TensorInfo|TensorInfo[];\n\n/** The function to run when computing a gradient during
backprop. */\n\nexport type GradFunc =\n  (dy: Tensor|Tensor[], saved: Tensor[], attrs: NamedAttrMap) =>\n  NamedGradientMap;\n\n/** Function that gets called after the backend initializes. */\n\nexport type KernelSetupFunc =
(backend: {}) => void;\n\n/** Function that gets called right before the backend is disposed. */\n\nexport type
KernelDisposeFunc = KernelSetupFunc;\n\n/** Config object for registering a kernel in the global registry. */\n\nexport interface KernelConfig {\n  kernelName: string;\n  backendName: string;\n  kernelFunc: KernelFunc;\n  setupFunc?: KernelSetupFunc;\n  disposeFunc?: KernelDisposeFunc;\n}\n\n/** Config object for registering a
gradient in the global registry. */\n\nexport interface GradConfig {\n  kernelName: string;\n  inputsToSave?:
string[];\n  // When saveAllInputs is true, all inputs will be saved. Only use this flag\n  // if inputs is an array of
Tensors.\n  saveAllInputs?: boolean;\n  outputsToSave?: boolean[];\n  gradFunc: GradFunc;\n}\n\n/** Holds

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metadata for a given tensor. */
export interface TensorInfo {
  dataId: DataId;
  shape: number[];
  dtype:
  DataType;
}
export interface NamedTensorInfoMap {
  [name: string]: TensorInfo;
}
export interface
NamedAttrMap {
  [name: string]: Attribute;
}
/**
 * Returns the kernel function (code) associated with the
provided names.
 * @param kernelName The official name of the kernel.
 * @param backendName The
official
name of the backend.
 */
export function getKernel(
  kernelName: string, backendName: string):
KernelConfig {
  const key = makeKey(kernelName, backendName);
  return kernelRegistry.get(key);
}
/**
 * Returns the registered gradient info associated with the provided kernel.
 * @param kernelName The official TF
kernel name.
 */
export function getGradient(kernelName: string): GradConfig {
  return
gradRegistry.get(kernelName);
}
export function getKernelsForBackend(backendName: string): KernelConfig[]
{
  const it = kernelRegistry.entries();
  const result: KernelConfig[] = [];
  while (true) {
    const {done,
value} = it.next();
    if (done) {
      break;
    }
    const [key, config] = value;
    const [backend, ] =
key.split('_');
    if (backend === backendName) {
      result.push(config);
    }
  }
  return result;
}
/**
 * Registers the function (forward pass) for the kernel in a global registry.
 * @param config A config object
with the following properties:
 * - `kernelName` The official name of the kernel.
 * - `backendName` The official
name of the backend.
 * - `kernelFunc` The function to run during the forward pass of the kernel.
 * - `setupFunc`
Optional. Gets called once, after the backend initializes.
 * - `disposeFunc` Optional. Gets called once, right before
the backend is
disposed.
 */
export function registerKernel(config: KernelConfig) {
  const {kernelName,
backendName} = config;
  const key = makeKey(kernelName, backendName);
  if (kernelRegistry.has(key)) {
    console.warn(
      `The kernel '${kernelName}' for backend ` +
      ` '${backendName}' is already
registered`);
  }
  kernelRegistry.set(key, config);
}
/**
 * Registers a gradient function for a given kernel in
the global registry,
 * to be used during the back-propagation of that kernel.
 * @param config An object with
the following properties:
 * - `kernelName` The name of the kernel that the gradient
function is for.
 * - `gradFunc` The function to run during back-propagation.
 */
export function
registerGradient(config: GradConfig) {
  const {kernelName} = config;
  if (gradRegistry.has(kernelName)) {
    // TODO (yassogba) after 3.0 assess whether we need to keep this gated
    // to debug mode.
    if
(env().getBool('DEBUG')) {
      console.warn(`Overriding the gradient for '${kernelName}'`);
    }
  }
  gradRegistry.set(kernelName, config);
}
/**
 * Removes the kernel function from the registry.
 * @param
kernelName The official name of the kernel.
 * @param backendName The official name of the backend.
 */
export function unregisterKernel(
  kernelName: string, backendName: string): void {
  const key =
makeKey(kernelName, backendName);
  if (!kernelRegistry.has(key)) {
    throw new Error(
      `The kernel
'${kernelName}' for backend ` +
      ` '${backendName}' is not registered`);
  }
  kernelRegistry.delete(key);
}
/**
 * Removes the registered gradient from the global registry.
 */
export function unregisterGradient(kernelName:
string): void {
  if (!gradRegistry.has(kernelName)) {
    throw new Error(
      `The gradient '${kernelName}'
for backend is not registered`);
  }
  gradRegistry.delete(kernelName);
}
/**
 * Finds kernels that have
already been registered to a backend and re-registers
 * them for a new backend. Useful for registering custom
backends.
 * @param registeredBackendName Already registered backend.
 * @param newBackendName New
backend.
 */
export function copyRegisteredKernels(
  registeredBackendName: string, newBackendName:
string): void {
  const kernels = getKernelsForBackend(registeredBackendName);
  kernels.forEach(kernelConfig
=> {
    const newKernelConfig =
Object.assign({}, kernelConfig, {backendName: newBackendName});
    registerKernel(newKernelConfig);
  });
}
function makeKey(kernelName: string, backendName: string) {
  return `${backendName}_${kernelName}`;
}
/**
 * @license
 * Copyright 2017 Google LLC. All Rights Reserved.
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2.0 (the "License");
 * you may not use this file except in compliance with the License.
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copy of the License at
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law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for

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the specific language governing permissions and limitations under the License.

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*\n\nimport {env} from './environment';\nimport {BackendValues, DataType, TensorLike, TypedArray} from './types';\nimport * as base from './util_base';\nexport * from './util_base';\n\n/**\n * Create typed array for scalar value. Used for storing\n * in `DataStorage`.\n */\nexport function createScalarValue(\n  value: DataType, dtype: DataType): BackendValues {\n  if (dtype === 'string') {\n    return encodeString(value);\n  }\n  return toTypedArray([value], dtype);\n}\n\nfunction noConversionNeeded(a: TensorLike, dtype: DataType): boolean {\n  return (a instanceof Float32Array && dtype === 'float32') ||\n    (a instanceof Int32Array && dtype === 'int32') ||\n    (a instanceof Uint8Array && dtype === 'bool');\n}\n\nexport function toTypedArray(a: TensorLike, dtype: DataType): TypedArray {\n  if (dtype === 'string') {\n    throw new Error('Cannot convert a string[] to a TypedArray');\n  }\n  if (Array.isArray(a)) {\n    a = base.flatten(a);\n  }\n  if (env().getBool('DEBUG')) {\n    base.checkConversionForErrors(a as number[], dtype);\n  }\n  if (noConversionNeeded(a, dtype)) {\n    return a as TypedArray;\n  }\n  if (dtype == null || dtype === 'float32' || dtype === 'complex64') {\n    return new Float32Array(a as number[]);\n  }\n  else if (dtype === 'int32') {\n    return new Int32Array(a as number[]);\n  }\n  else if (dtype === 'bool') {\n    const bool = new Uint8Array((a as number[]).length);\n    for (let i = 0; i < bool.length; ++i) {\n      if (Math.round((a as number[])[i]) !== 0) {\n        bool[i] = 1;\n      }\n    }\n    return bool;\n  }\n  else {\n    throw new Error('Unknown data type ${dtype}');\n  }\n}\n\n/**\n * Returns the current high-resolution time in milliseconds relative to an\n * arbitrary time in the past. It works across different platforms (node.js,\n * browsers).\n */\nexport function now(): number {\n  return env().platform.now();\n}\n\n/**\n * Returns a platform-specific implementation of\n * [fetch](https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API).\n * If `fetch` is defined on the global object (`window`, `process`, etc.),\n * `tf.util.fetch` returns that function.\n * If not, `tf.util.fetch` returns a platform-specific solution.\n */\nexport function fetch(\n  path: string, requestInits?: RequestInit): Promise<Response> {\n  return env().platform.fetch(path, requestInits);\n}\n\n/**\n * Encodes the provided string into bytes using the provided encoding scheme.\n * @param s The string to encode.\n * @param encoding The encoding scheme. Defaults to utf-8.\n */\nexport function encodeString(s: string, encoding = 'utf-8'): Uint8Array {\n  encoding = encoding || 'utf-8';\n  return env().platform.encode(s, encoding);\n}\n\n/**\n * Decodes the provided bytes into a string using the provided encoding scheme.\n * @param bytes The bytes to decode.\n * @param encoding The encoding scheme. Defaults to utf-8.\n */\nexport function decodeString(bytes: Uint8Array, encoding = 'utf-8'): string {\n  encoding = encoding || 'utf-8';\n  return env().platform.decode(bytes, encoding);\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====
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*\n\nimport {BackendTimer, BackendTimingInfo} from './backends/backend';\nimport {env} from './environment';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {DataType, DataTypeMap, TypedArray} from './types';\nimport * as util from './util';\nexport type KernelProfile = {\n  kernelName: string,\n  outputs: Tensor[],\n  inputs: NamedTensorMap,\n  timeMs: Promise<number|{error: string}>,\n  extraInfo: Promise<string>};\n\nexport class Profiler {\n  constructor(private backendTimer: BackendTimer, private logger?:
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Logger) {\n  if (logger == null) {\n    this.logger = new Logger();\n  }\n}\n\nprofileKernel(kernelName: string,
inputs: NamedTensorMap, f: () => Tensor[]):\n  KernelProfile {\n    let outputs: Tensor[];\n    const
holdResultWrapperFn = () => {\n      outputs = f();\n    };\n    let timer: Promise<BackendTimingInfo>;\n    const
start = util.now();\n    if (this.backendTimer.timerAvailable()) {\n      timer =
this.backendTimer.time(holdResultWrapperFn);\n    } else {\n      holdResultWrapperFn();\n      outputs.map(output
=> output.dataSync());\n
      timer = Promise.resolve({kernelMs: util.now() - start});\n    }\n    if
(env().getBool('CHECK_COMPUTATION_FOR_ERRORS')) {\n      for (let i = 0; i < outputs.length; i++) {\n
const output = outputs[i];\n        // Dangling promise here because we don't want to propagate up\n        //
asynchronicity.\n        output.data().then(tensorVals => {\n          checkComputationForErrors(tensorVals,
output.dtype, kernelName);\n        });\n      }\n    }\n    const kernelProfile = {\n      kernelName,\n      outputs,\n      inputs,\n      timeMs: timer.then(timing => timing.kernelMs),\n      extraInfo: timer.then(\n        timing =>
timing.getExtraProfileInfo != null ?\n          timing.getExtraProfileInfo() :\n          "")\n    };\n    return
kernelProfile;\n  }\n}\n\nlogKernelProfile(kernelProfile: KernelProfile): void {\n  const {kernelName, outputs,
timeMs, inputs, extraInfo} = kernelProfile;\n  outputs.forEach(result => {\n    Promise.all([result.data(),
timeMs, extraInfo]).then(valueContainer => {\n      this.logger.logKernelProfile(\n        kernelName, result,
valueContainer[0], valueContainer[1], inputs,\n        valueContainer[2]);\n    });\n  });\n}\n\nexport
function checkComputationForErrors<D extends DataType>(\n  vals: DataTypeMap[D], dtype: D, kernelName:
string): boolean {\n  if (dtype !== 'float32') {\n    // Only floating point computations will generate NaN values\n
return false;\n  }\n  for (let i = 0; i < vals.length; i++) {\n    const num = vals[i] as number;\n    if (isNaN(num) ||
!isFinite(num)) {\n      // Throwing custom exception so behavior is testable.\n      console.warn(` Found ${num} in
the result of '${kernelName}'`);\n      return true;\n    }\n  }\n  return false;\n}\n\nexport class Logger {\n
logKernelProfile(\n  name: string, result: Tensor, vals: TypedArray,\n  timeMs: number|{error: string}, inputs:
NamedTensorMap,\n  extraInfo?: string) {\n  const time
= typeof timeMs === 'number' ? util.rightPad(`${timeMs}ms`, 9) :\n
timeMs['error'];\n  const paddedName = util.rightPad(name, 25);\n  const rank = result.rank;\n  const size = result.size;\n  const
shape = util.rightPad(result.shape.toString(), 14);\n  let inputShapesDescription = ";\n  for (const name in
inputs) {\n    const input = inputs[name];\n    if (input != null) {\n      // The input might be a non-tensor (e.g
HTMLImageElement), in which case\n      // we claim the output shape as input shape.\n      const inputShape =
input.shape || result.shape;\n      const inputRank = inputShape.length;\n      inputShapesDescription +=\n
`${name}: ${inputRank}D ${inputRank > 0 ? inputShape : " "}`;\n    }\n  }\n  console.log(\n
`%c${paddedName} \\t%c${time} \\t%c${rank}D ${shape} \\t%c${size} \\t%c${\n
inputShapesDescription} \\t%c${extraInfo}`, \n    'font-weight:bold', 'color:red',
'color:blue', 'color: orange', \n    'color: green', 'color: steelblue');\n  }\n}\n", /**\n * @license\n * Copyright 2017
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from
'/util';\n\nexport interface TapeNode {\n  id: number;\n  kernelName: string;\n
outputs: Tensor[];\n  inputs: NamedTensorMap;\n  // Optional params, defined only for ops with gradient impl.\n
gradient?: (dys: Tensor[]) => NamedGradientMap;\n  saved?: Tensor[];\n}\n\nexport type NamedGradientMap = {\n
[inputName: string]: () => Tensor;\n};\n\n/**\n * Computes a list of TapeNodes that connect x to y, filtering
everything else\n * out and preserving the order of the original tape elements.\n * @param tape The tape
elements to filter.\n * @param xs The input Tensors.\n * @param y The output Tensor.\n */\n\nexport function

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getFilteredNodesXToY(\n  tape: TapeNode[], xs: Tensor[], y: Tensor): TapeNode[] {\n // Forward pass to
compute all the nodes and Tensors that are transitively a\n // function of x.\n  const tensorsFromX: {[tensorId:
number]: boolean} = {};\n  const nodesFromX: {[nodeId: number]: boolean} = {};\n  for (let i = 0; i < xs.length;
i++) {\n    tensorsFromX[xs[i].id] = true;\n  }\n  for (let i = 0; i < tape.length; i++) {\n    const node = tape[i];\n    const nodeInputs = node.inputs;\n    for (const inputName in nodeInputs) {\n      const input =
nodeInputs[inputName];\n      let anyInputFromX = false;\n      for (let j = 0; j < xs.length; j++) {\n        if
(tensorsFromX[input.id]) {\n          node.outputs.forEach(output => tensorsFromX[output.id] = true);\n          anyInputFromX = true;\n          nodesFromX[node.id] = true;\n          break;\n        }\n      }\n      if
(anyInputFromX) {\n        break;\n      }\n    }\n  }\n  // Backward pass to find all of the nodes and Tensors that
lead to y.\n  const tensorsLeadToY: {[tensorId: number]: boolean} = {};\n  tensorsLeadToY[y.id] = true;\n  const
nodesToY: {[nodeId: number]: boolean} = {};\n  for (let i = tape.length - 1; i >= 0; i--) {\n    const node =
tape[i];\n    const nodeInputs = node.inputs;\n    // If any of the outputs lead to y, mark all of the inputs as leading
to y.\n    for (let j = 0; j < node.outputs.length; j++) {\n      if (tensorsLeadToY[node.outputs[j].id])
{\n        for (const inputName in nodeInputs) {\n          tensorsLeadToY[nodeInputs[inputName].id] = true;\n          nodesToY[node.id] = true;\n          }\n        break;\n      }\n    }\n  }\n  // Return the paths that come from x and lead
to y.\n  const filteredTape: TapeNode[] = [];\n  for (let i = 0; i < tape.length; i++) {\n    const node = tape[i];\n    if
(nodesFromX[node.id] && nodesToY[node.id]) {\n      // Prune the inputs from the node that aren't a function of
x.\n      const prunedInputs: {[inputName: string]: Tensor} = {};\n      for (const inputName in node.inputs) {\n
const nodeInput = node.inputs[inputName];\n      if (tensorsFromX[nodeInput.id]) {\n        prunedInputs[inputName] = nodeInput;\n      }\n    }\n    // Copy the node and overwrite inputsAndArgs to the
pruned version.\n    const prunedNode = Object.assign({}, node);\n    prunedNode.inputs = prunedInputs;\n    prunedNode.outputs = node.outputs;\n    filteredTape.push(prunedNode);\n  }\n  }\n  return filteredTape;\n}\n\n/**\n * Backpropagate gradients through the filtered TapeNodes.\n *\n * @param tensorAccumulatedGradientMap A map of Tensor to its gradient. This map\n * is mutated by this
method.\n * @param filteredTape The filtered TapeNodes to backprop through.\n *\n export function
backpropagateGradients(\n  tensorAccumulatedGradientMap: {[tensorId: number]: Tensor},\n  filteredTape:
TapeNode[], tidy: (f: Function) => Tensor,\n  add: (a: Tensor, b: Tensor) => Tensor) {\n // Walk the tape
backward and keep a map of Tensor to its gradient.\n  for (let i = filteredTape.length - 1; i >= 0; i--) {\n    const node
= filteredTape[i];\n    const dys: Tensor[] = [];\n    node.outputs.forEach(o => {\n      const gradTensor =
tensorAccumulatedGradientMap[o.id];\n      if (gradTensor !== null) {\n        dys.push(gradTensor);\n      } else {\n
// This particular output is not in the back-propagation subgraph, so it\n
// does not affect the final output, thus we put null for its dy.\n        dys.push(null);\n      }\n    });\n    if
(node.gradient === null) {\n      throw new Error(\n        `Cannot compute gradient: gradient function not found ` +\n
        `for ${node.kernelName}.`);\n    }\n    // Backprop dy through this node and accumulate gradients over the
inputs.\n    const inputGradients = node.gradient(dys);\n    for (const inputName in node.inputs) {\n      if
(!inputName in inputGradients) {\n        throw new Error(\n          `Cannot backprop through input
${inputName}. ` +\n          `Available gradients found: ${Object.keys(inputGradients)}.`);\n      }\n    }\n    // Call the
gradient function.\n    const dx = tidy(() => inputGradients[inputName]());\n    if (dx.dtype !== 'float32') {\n
throw new Error(\n      `Error in gradient for op ${\n        node.kernelName}. The gradient of input ` +\n
      `${inputName} must have 'float32' dtype, but
has '${dx.dtype}'`);\n    }\n    const x = node.inputs[inputName];\n    if (!util.arraysEqual(dx.shape, x.shape)) {\n
throw new Error(\n      `Error in gradient for op ${\n        node.kernelName}. The gradient of input ` +\n
      `${inputName} has shape '${dx.shape}', which does not match ` +\n
      `the shape of the input
'${x.shape}'`);\n    }\n    if (tensorAccumulatedGradientMap[x.id] === null) {\n      tensorAccumulatedGradientMap[x.id] = dx;\n    } else {\n      const curGradient =
tensorAccumulatedGradientMap[x.id];\n      tensorAccumulatedGradientMap[x.id] = add(curGradient, dx);\n      curGradient.dispose();\n    }\n  }\n  }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
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=====\n*\n\nimport {DataType, TypedArray} from './types';\nimport {computeStrides, isString, rightPad, sizeFromShape} from './util';\n\n// Maximum number of values before we decide to show ellipsis.\nconst FORMAT_LIMIT_NUM_VALS = 20;\n// Number of first and last values to show when displaying a, b,...,y, z.\nconst FORMAT_NUM_FIRST_LAST_VALS = 3;\n// Number of significant digits to show.\nconst FORMAT_NUM_SIG_DIGITS = 7;\n\nexport function tensorToString(\n  vals: TypedArray|string[], shape: number[], dtype: DataType,\n  verbose: boolean) {\n  const strides = computeStrides(shape);\n  const padPerCol = computeMaxSizePerColumn(vals, shape, dtype, strides);\n  const rank = shape.length;\n  const valsLines = subTensorToString(vals, shape, dtype, strides, padPerCol);\n  const lines = ['Tensor'];\n  if (verbose) {\n    lines.push(` dtype: ${dtype}`);\n    lines.push(` rank: ${rank}`);\n    lines.push(` shape: [${shape}]`);\n  }\n  lines.push(` values:`);\n  lines.push(valsLines.map(l => ` ` + l).join(`\\n`));\n  return lines.join(`\\n`);\n}\n\nfunction computeMaxSizePerColumn(\n  vals: TypedArray|string[], shape: number[], dtype: DataType,\n  strides: number[]): number[] {\n  const n = sizeFromShape(shape);\n  const numCols = strides[strides.length - 1];\n  const padPerCol = new Array(numCols).fill(0);\n  const rank = shape.length;\n  const valuesOrTuples =\n    dtype === 'complex64' ? createComplexTuples(vals) : vals;\n  if (rank > 1) {\n    for (let row = 0; row < n / numCols; row++) {\n      const offset = row * numCols;\n      for (let j = 0; j < numCols; j++) {\n        padPerCol[j] = Math.max(\n          padPerCol[j],\n          valToString(valuesOrTuples[offset + j], 0, dtype).length);\n      }\n    }\n  }\n  return padPerCol;\n}\n\nfunction valToString(\n  val: number|string|[number, number], pad: number, dtype: DataType) {\n  let valStr: string;\n  if (Array.isArray(val)) {\n    valStr = `${parseFloat(val[0].toFixed(FORMAT_NUM_SIG_DIGITS))} + ` +\n      `${parseFloat(val[1].toFixed(FORMAT_NUM_SIG_DIGITS))}j`;\n  } else if (isString(val)) {\n    valStr = `_${val}`;\n  } else if (dtype === 'bool') {\n    valStr = boolNumToString(val);\n  } else {\n    valStr = parseFloat(val.toFixed(FORMAT_NUM_SIG_DIGITS)).toString();\n  }\n  return rightPad(valStr, pad);\n}\n\nfunction boolNumToString(v: number): string {\n  return v === 0 ? 'false' : 'true';\n}\n\nfunction subTensorToString(\n  vals: TypedArray|string[], shape: number[], dtype: DataType,\n  strides: number[], padPerCol: number[], isLast = true):\n  string[] {\n  const storagePerElement = dtype === 'complex64' ? 2 : 1;\n  const size = shape[0];\n  const rank = shape.length;\n  if (rank === 0) {\n    if (dtype === 'complex64') {\n      const complexTuple = createComplexTuples(vals);\n      return [valToString(complexTuple[0], 0, dtype)];\n    }\n    if (dtype === 'bool') {\n      return [boolNumToString(vals[0] as number)];\n    }\n    return [vals[0].toString()];\n  }\n  if (rank === 1) {\n    if (size > FORMAT_LIMIT_NUM_VALS) {\n      const firstValsSize =\n        FORMAT_NUM_FIRST_LAST_VALS * storagePerElement;\n      let firstVals =\n        Array.from<number|string|[number, number]>(\n          vals.slice(0, firstValsSize));\n      let lastVals =\n        Array.from<number|string|[number, number]>(\n          vals.slice(\n            (size - FORMAT_NUM_FIRST_LAST_VALS) * storagePerElement,\n            size * storagePerElement));\n      if (dtype === 'complex64') {\n        firstVals = createComplexTuples(firstVals);\n        lastVals = createComplexTuples(lastVals);\n      }\n      return [\n        '[' +\n          firstVals.map((x, i) => valToString(x, padPerCol[i], dtype))\n            .join(', ')\n        +\n          ', ..., ' +\n          lastVals\n            .map(\n              (x, i) => valToString(\n                x, padPerCol[size -\n                  FORMAT_NUM_FIRST_LAST_VALS + i], dtype))\n            .join(', ')\n        +\n          ']' +\n          '\\n '];\n    }\n    const displayVals: Array<number|string|[number, number]> =\n      dtype === 'complex64' ? createComplexTuples(vals)\n        : Array.from<number|string>(vals);\n    return [\n      '[' +\n        displayVals.map((x, i) => valToString(x, padPerCol[i], dtype))\n          .join(', ')\n        +\n          '\\n '];\n  }\n  // The array is rank 2 or more.\n  const
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subshape = shape.slice(1);\n const substrides = strides.slice(1);\n const stride = strides[0] * storagePerElement;\n
const lines: string[] = [];\n if (size > FORMAT_LIMIT_NUM_VALS) {\n for (let i = 0; i <
FORMAT_NUM_FIRST_LAST_VALS;\n
i++) {\n const start = i * stride;\n const end = start + stride;\n lines.push(...subTensorToString(\n
vals.slice(start, end), subshape, dtype, substrides, padPerCol,\n false /* isLast */));\n } \n lines.push('...');\n
for (let i = size - FORMAT_NUM_FIRST_LAST_VALS; i < size; i++) {\n const start = i * stride;\n const end
= start + stride;\n lines.push(...subTensorToString(\n vals.slice(start, end), subshape, dtype, substrides,\n
padPerCol,\n i === size - 1 /* isLast */));\n } \n } else {\n for (let i = 0; i < size; i++) {\n const start = i *
stride;\n const end = start + stride;\n lines.push(...subTensorToString(\n vals.slice(start, end), subshape,\n
dtype, substrides, padPerCol,\n i === size - 1 /* isLast */));\n } \n } \n const sep = rank === 2 ? ',': '';\n
lines[0] = '[' + lines[0] + sep;\n for (let i = 1; i < lines.length - 1; i++) {\n lines[i] = ' ' + lines[i]
+ sep;\n } \n let newLineSep = ',\n';\n for (let i = 2; i < rank; i++) {\n newLineSep += '\n';\n } \n
lines[lines.length - 1] = '\n ' + lines[lines.length - 1] + ']' + (isLast ? '' : newLineSep);\n return
lines;\n }\n\nfunction createComplexTuples(vals: Array<{}> | \n TypedArray): Array<[number,\n
number]> {\n const complexTuples: Array<[number, number]> = [];\n for (let i = 0; i < vals.length; i += 2) {\n
complexTuples.push([vals[i], vals[i + 1]] as [number, number]);\n } \n return complexTuples;\n }\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {getGlobal} from './global_util';\nimport {tensorToString} from './tensor_format';\nimport {ArrayMap,\nBackendValues, DataTypeMap, DataValues, NumericDataType, Rank, ShapeMap, SingleValueMap,\nTypedArray} from './types';\nimport * as util from './util';\nimport {computeStrides, toNestedArray} from
'/util';\n\nexport interface TensorData<D extends DataType> {\n dataId?: DataId;\n values?:\n
DataTypeMap[D];\n}\n\n// This interface mimics KernelBackend (in backend.ts), which would create a\n// circular
dependency if imported.\n\nexport interface Backend {} \n\n/**\n * A mutable object, similar to `tf.Tensor`, that
allows users to set values\n * at locations before converting to an immutable `tf.Tensor`.\n
*\n * See `tf.buffer` for creating a tensor buffer.\n * \n * @doc {heading: 'Tensors', subheading: 'Classes'}\n
*/\n\nexport class TensorBuffer<R extends Rank, D extends DataType = 'float32'> {\n size: number;\n shape:\n
ShapeMap[R];\n strides: number[];\n values: DataTypeMap[D];\n\n constructor(shape: ShapeMap[R], public\n
dtype: D, values?: DataTypeMap[D]) {\n this.shape = shape.slice() as ShapeMap[R];\n this.size =\n
util.sizeFromShape(shape);\n\n if (values != null) {\n const n = values.length;\n util.assert(\n n ===\n
this.size,\n () => `Length of values '${n}' does not match the size ` +\n `inferred by the shape\n
'${this.shape}`);\n } \n\n if (dtype === 'complex64') {\n throw new Error(\n `complex64 dtype\n
TensorBuffers are not supported. Please create ` +\n `a TensorBuffer for the real and imaginary parts\n
separately and ` +\n `call tf.complex(real, imag).`);\n } \n\n this.values = values ||\n
util.getArrayFromDType(dtype, this.size);\n this.strides = computeStrides(shape);\n } \n\n /**\n * Sets a value
in the buffer at a given location.\n * \n * @param value The value to set.\n * @param locs The location
indices.\n * \n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\n\n set(value: SingleValueMap[D], ...locs:\n
number[]): void {\n if (locs.length === 0) {\n locs = [0];\n } \n\n util.assert(\n locs.length === this.rank,\n
() => `The number of provided coordinates (${locs.length}) must ` +\n `match the rank\n
(${this.rank}`);\n\n const index = this.locToIndex(locs);\n this.values[index] = value as number;\n } \n\n /**\n
* Returns the value in the buffer at the provided location.\n * \n * @param locs The location indices.\n * \n *
@doc {heading: 'Tensors', subheading: 'Creation'}\n */\n\n get(...locs: number[]): SingleValueMap[D] {\n if\n
(locs.length === 0) {\n locs = [0];\n } \n\n let i = 0;\n

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    for (const loc of locs) {\n      if (loc < 0 || loc >= this.shape[i]) {\n        const msg = `Requested out of range
element at ${locs}.` +\n          ` Buffer shape=${this.shape}`;\n        throw new Error(msg);\n      }\n      i++;\n    }\n    let index = locs[locs.length - 1];\n    for (let i = 0; i < locs.length - 1; ++i) {\n      index += this.strides[i] *
locs[i];\n    }\n    return this.values[index] as SingleValueMap[D];\n  }\n\n  locToIndex(locs: number[]): number {\n    if (this.rank === 0) {\n      return 0;\n    } else if (this.rank === 1) {\n      return locs[0];\n    }\n    let index =
locs[locs.length - 1];\n    for (let i = 0; i < locs.length - 1; ++i) {\n      index += this.strides[i] * locs[i];\n    }\n    return index;\n  }\n\n  indexToLoc(index: number): number[] {\n    if (this.rank === 0) {\n      return [];\n    } else if
(this.rank === 1) {\n      return [index];\n    }\n    const locs: number[] = new Array(this.shape.length);\n    for (let i =
0; i < locs.length
- 1; ++i) {\n      locs[i] = Math.floor(index / this.strides[i]);\n      index -= locs[i] * this.strides[i];\n    }\n    locs[locs.length - 1] = index;\n    return locs;\n  }\n\n  get rank() {\n    return this.shape.length;\n  }\n\n  /**\n   *
Creates an immutable `tf.Tensor` object from the buffer.\n   * @doc {heading: 'Tensors', subheading:
'Creation'}\n   */\n  toTensor(): Tensor<R> {\n    return trackerFn().makeTensor(this.values, this.shape, this.dtype)
as\n    Tensor<R>;\n  }\n\n  namespace TensorTracker {\n    makeTensor(values: DataValues, shape:
number[], dtype: DataType, backend?: Backend): Tensor;\n    makeVariable(initialValue: Tensor,
trainable?: boolean, name?: string, dtype?: DataType): Variable;\n    incRef(a: Tensor, backend: Backend):
void;\n    disposeTensor(t: Tensor): void;\n    disposeVariable(v: Variable): void;\n    read(dataId: DataId):
Promise<BackendValues>;\n    readSync(dataId: DataId): BackendValues;\n  }\n\n  /**\n   *
The Tensor class calls into this handler to delegate chaining operations.\n   */\n  namespace OpHandler {\n
cast<T extends Tensor>(x: T, dtype: DataType): T;\n    buffer<R extends Rank, D extends DataType>(shape:
ShapeMap[R], dtype: D, values?: DataTypeMap[D]): TensorBuffer<R, D>;\n    print<T extends Tensor>(x: T,
verbose: boolean): void;\n    clone<T extends Tensor>(x: T): T;\n    // TODO(yassogba) bring reshape back?\n  }\n\n  //
For tracking tensor creation and disposal.\n  let trackerFn: () => TensorTracker = null;\n  // Used by chaining methods
to call into ops.\n  let opHandler: OpHandler = null;\n  // Used to warn about deprecated methods.\n  let
deprecationWarningFn: (msg: string) => void = null;\n  // This here so that we can use this method on dev branches
and keep the\n  // functionality at master.\n  // tslint:disable-next-line:no-unused-
expression\n  [deprecationWarningFn];\n\n  /**\n   * An external consumer can register itself as the tensor tracker. This
way\n   * the Tensor class can
notify the tracker for every tensor created and\n   * disposed.\n   */\n  namespace setTensorTracker(fn: () =>
TensorTracker) {\n    trackerFn = fn;\n  }\n\n  /**\n   * An external consumer can register itself as the op handler. This
way the\n   * Tensor class can have chaining methods that call into ops via the op\n   * handler.\n   */\n  namespace
setOpHandler(handler: OpHandler) {\n    opHandler = handler;\n  }\n\n  /**\n   * Sets the deprecation warning function
to be used by this file. This way the\n   * Tensor class can be a leaf but still use the environment.\n   */\n  namespace
setDeprecationWarningFn(fn: (msg: string) => void) {\n    deprecationWarningFn = fn;\n  }\n\n  /**\n   * We
wrap data id since we use weak map to avoid memory leaks.\n   * Since we have our own memory management, we
have a reference counter\n   * mapping a tensor to its data, so there is always a pointer (even if that\n   * data is
otherwise garbage collectable).\n   * See https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/\n   \* Global\_Objects/WeakMap\n   */\n  namespace type DataId = object; // object instead of {} to force non-primitive.\n\n  //
Declare this namespace to make Tensor class augmentation work in google3.\n  namespace Tensor {\n    /**\n     * A `tf.Tensor`
object represents an immutable, multidimensional array of\n     * numbers that has a shape
and a data type.\n     */\n    /**\n     * See `tf.tensor` for details on how to create a `tf.Tensor`.\n     */\n    /**\n     * @doc {heading: 'Tensors',
subheading: 'Classes'}\n     */\n    class Tensor<R extends Rank = Rank> {\n      /**\n       * Unique id of this tensor.
*\n       * readonly id: number;\n       */\n      /**\n       * Id of the bucket holding the data for this tensor. Multiple arrays can\n       * point to
the same bucket (e.g. when calling array.reshape()).\n       */\n      dataId: DataId;\n      /**\n       * The shape of the tensor.
*\n       * readonly shape: ShapeMap[R];\n       */\n      /**\n       * Number of elements in the tensor.
*\n       * readonly size: number;\n       */\n      /**\n       * The data
type for the array.
*\n       * readonly dtype: DataType;\n       */\n      /**\n       * The rank type for
the array (see `Rank` enum).
*\n       * readonly rankType: R;\n       */\n      /**\n       * Whether this tensor has been globally kept.
*\n       * kept = false;\n       */\n      /**\n       * The id of the scope this tensor is being tracked in.
*\n       * scopeId: number;\n       */\n      /**\n       * Number

```


of elements to skip in each dimension when indexing. See <https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.strides.html> `readonly strides: number[];`

```

constructor(shape: ShapeMap[R], dtype: DataType, dataId: DataId, id: number) {
  this.shape = shape.slice() as ShapeMap[R];
  this.dtype = dtype || 'float32';
  this.size = util.sizeFromShape(shape);
  this.strides = computeStrides(shape);
  this.dataId = dataId;
  this.id = id;
  this.rankType = (this.rank < 5 ? this.rank.toString() : 'higher') as R;
}

get rank(): number {
  return this.shape.length;
}

/**
 * Returns a promise of `tf.TensorBuffer` that holds the underlying data.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
async buffer<D extends DataType = 'float32'>(): Promise<TensorBuffer<R, D>> {
  const vals = await this.data<D>();
  return opHandler.buffer(this.shape, this.dtype as D, vals);
}

/**
 * Returns a `tf.TensorBuffer` that holds the underlying data.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
bufferSync<D extends DataType = 'float32'>(): TensorBuffer<R, D> {
  return opHandler.buffer(this.shape, this.dtype as D, this.dataSync());
}

/**
 * Returns the tensor data as a nested array. The transfer of data is done asynchronously.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
async array(): Promise<ArrayMap[R]> {
  const vals = await this.data();
  return toNestedArray(this.shape, vals) as ArrayMap[R];
}

/**
 * Returns the tensor data as a nested array. The transfer of data is done synchronously.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
arraySync(): ArrayMap[R] {
  return toNestedArray(this.shape, this.dataSync()) as ArrayMap[R];
}

/**
 * Asynchronously downloads the values from the `tf.Tensor`. Returns a promise of `TypedArray` that resolves when the computation has finished.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
async data<D extends DataType = NumericDataType>(): Promise<DataTypeMap[D]> {
  this.throwIfDisposed();
  const data = trackerFn().read(this.dataId);
  if (this.dtype === 'string') {
    const bytes = await data as Uint8Array[];
    try {
      return bytes.map(b => util.decodeString(b)) as DataTypeMap[D];
    } catch {
      throw new Error(`Failed to decode the string bytes into utf-8. To get the original bytes, call tensor.bytes().`);
    }
  }
  return data as Promise<DataTypeMap[D]>;
}

/**
 * Synchronously downloads the values from the `tf.Tensor`. This blocks the UI thread until the values are ready, which can cause performance issues.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
dataSync<D extends DataType = NumericDataType>(): DataTypeMap[D] {
  this.throwIfDisposed();
  const data = trackerFn().readSync(this.dataId);
  if (this.dtype === 'string') {
    try {
      return (data as Uint8Array[]).map(b => util.decodeString(b)) as DataTypeMap[D];
    } catch {
      throw new Error(`Failed to decode the string bytes into utf-8. To get the original bytes, call tensor.bytes().`);
    }
  }
  return data as DataTypeMap[D];
}

/**
 * Returns the underlying bytes of the tensor's data.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
async bytes(): Promise<Uint8Array[]|Uint8Array> {
  this.throwIfDisposed();
  const data = await trackerFn().read(this.dataId);
  if (this.dtype === 'string') {
    return data as Uint8Array[];
  } else {
    return new Uint8Array((data as TypedArray).buffer);
  }
}

/**
 * Disposes `tf.Tensor` from memory.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
dispose(): void {
  if (this.isDisposed) {
    return;
  }
  trackerFn().disposeTensor(this);
  this.isDisposedInternal = true;
}

protected isDisposedInternal = false;

get isDisposed(): boolean {
  return this.isDisposedInternal;
}

throwIfDisposed() {
  if (this.isDisposed) {
    throw new Error(`Tensor is disposed.`);
  }
}

/**
 * Prints the `tf.Tensor`. See `tf.print` for details.
 * @param verbose Whether to print verbose information about the tensor, including dtype and size.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
print(verbose = false): void {
  return opHandler.print(this, verbose);
}

/**
 * Returns a copy of the tensor. See `tf.clone` for details.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
clone<T extends Tensor>(this: T): T {
  this.throwIfDisposed();
  return opHandler.clone(this);
}

/**
 * Returns a human-readable description of the tensor. Useful for logging.
 * @doc {heading: 'Tensors', subheading: 'Classes'}
 */
toString(verbose = false): string {
  const vals = this.dataSync();
  return tensorToString(vals, this.shape, this.dtype, verbose);
}

cast<T extends this>(dtype: DataType): T {

```

```

this.throwIfDisposed();\n    return opHandler.cast(this as T, dtype);\n  }\n  variable(trainable = true, name?: string,
dtype?: DataType): Variable<R> {\n    this.throwIfDisposed();\n    return trackerFn().makeVariable(this, trainable,
name, dtype) as\n      Variable<R>;\n  }\n}\nObject.defineProperty(Tensor, Symbol.hasInstance, {\n  value:
(instance: Tensor) => {\n    // Implementation note: we should use properties of the object that will be\n    // defined
before the constructor body has finished executing (methods).\n    // This
is because when this code is transpiled by babel, babel will call\n    // classCallCheck before the constructor body is
run.\n    // See https://github.com/tensorflow/tfjs/issues/3384 for backstory.\n    return !!instance && instance.data !==
null && instance.dataSync !== null &&\n      instance.throwIfDisposed !== null;\n  }\n});\n\nexport function
getGlobalTensorClass() {\n  // Use getGlobal so that we can augment the Tensor class across package\n  //
boundaries because the node resolution alg may result in different modules\n  // being returned for this file depending
on the path they are loaded from.\n  return getGlobal('Tensor', () => {\n    return Tensor;\n  });\n}\n\n// Global side
effect. Cache global reference to Tensor class\ngetGlobalTensorClass();\n\nexport interface NumericTensor<R
extends Rank = Rank> extends Tensor<R> {\n  dtype: NumericDataType;\n  dataSync<D extends DataType =
NumericDataType>(): DataTypeMap[D];\n  data<D extends DataType = NumericDataType>():
Promise<DataTypeMap[D]>;\n}\n\nexport
interface StringTensor<R extends Rank = Rank> extends Tensor<R> {\n  dtype: 'string';\n  dataSync<D extends
DataType = 'string'>(): DataTypeMap[D];\n  data<D extends DataType = 'string'>():
Promise<DataTypeMap[D]>;\n}\n\n/** @doclink Tensor */\nexport type Scalar = Tensor<Rank.R0>;\n\n/**
@doclink Tensor */\nexport type Tensor1D = Tensor<Rank.R1>;\n\n/** @doclink Tensor */\nexport type Tensor2D
= Tensor<Rank.R2>;\n\n/** @doclink Tensor */\nexport type Tensor3D = Tensor<Rank.R3>;\n\n/** @doclink Tensor
*/\nexport type Tensor4D = Tensor<Rank.R4>;\n\n/** @doclink Tensor */\nexport type Tensor5D =
Tensor<Rank.R5>;\n\n/** @doclink Tensor */\nexport type Tensor6D = Tensor<Rank.R6>;\n\n/**\n * A mutable
`tf.Tensor`, useful for persisting state, e.g. for training.\n * \n * @doc {heading: 'Tensors', subheading: 'Classes'}\n
*/\nexport class Variable<R extends Rank = Rank> extends Tensor<R> {\n  name: string;\n\n  constructor(\n
initialValue: Tensor<R>, public trainable: boolean,
name: string,\n  tensorId: number) {\n    super(\n      initialValue.shape, initialValue.dtype, initialValue.dataId,
tensorId);\n    this.name = name;\n  }\n\n  /**\n   * Assign a new `tf.Tensor` to this variable. The new `tf.Tensor`
must have\n   * the same shape and dtype as the old `tf.Tensor`.\n   * \n   * @param newValue New tensor to be
assigned to this variable.\n   * \n   * @doc {heading: 'Tensors', subheading: 'Classes'}\n   */\n  assign(newValue:
Tensor<R>): void {\n    if (newValue.dtype !== this.dtype) {\n      throw new Error(\n        `dtype of the new value
(${newValue.dtype}) and ` +\n        `previous value (${this.dtype}) must match`);\n    }\n    if
(!util.arraysEqual(newValue.shape, this.shape)) {\n      throw new Error(\n        `shape of the new value
(${newValue.shape}) and ` +\n        `previous value (${this.shape}) must match`);\n    }\n    trackerFn().disposeTensor(this);\n    this.dataId = newValue.dataId;\n    trackerFn().incRef(this, null
/* backend */);\n  }\n\n  dispose(): void {\n    trackerFn().disposeVariable(this);\n    this.isDisposedInternal = true;\n
}\n}\n\nObject.defineProperty(Variable, Symbol.hasInstance, {\n  value: (instance: Variable) => {\n    return
instance instanceof Tensor && instance.assign !== null &&\n      instance.assign instanceof Function;\n  }\n});\n\n", /**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
\n
=====*\n\n/**\n * @docalias number[] */\nexport interface ShapeMap {\n  R0: number[];\n  R1: [number];\n  R2: [number,
number];\n  R3: [number, number, number];\n  R4: [number, number, number, number];\n  R5: [number, number,
number, number, number];\n  R6: [number, number, number, number, number, number];\n}\n\n/**\n * @docalias
number[] */\nexport interface ArrayMap {\n  R0: number;\n  R1: number[];\n  R2: number[][];\n  R3:

```

```

number[][][];\n R4: number[][][];\n R5: number[][][];\n R6: number[][][];\n}\n\nexport interface
DataTypeMap {\n float32: Float32Array;\n int32: Int32Array;\n bool: Uint8Array;\n complex64: Float32Array;\n
string: string[];\n}\n\nexport interface SingleValueMap {\n bool: boolean;\n int32: number;\n float32: number;\n
complex64: number;\n string: string;\n}\n\n/** @docalias 'float32'|'int32'|'bool'|'complex64'|'string' */\nexport type
DataType = keyof DataTypeMap;\nexport type NumericDataType
= 'float32'|'int32'|'bool'|'complex64';\nexport type TypedArray = Float32Array|Int32Array|Uint8Array;\n\n/** Tensor
data used in tensor creation and user-facing API. */\nexport type DataValues = DataTypeMap[DataType];\n\n/** The
underlying tensor data that gets stored in a backend. */\nexport type BackendValues =
Float32Array|Int32Array|Uint8Array|Uint8Array[];\n\nexport enum Rank {\n R0 = 'R0',\n R1 = 'R1',\n R2 =
'R2',\n R3 = 'R3',\n R4 = 'R4',\n R5 = 'R5',\n R6 = 'R6'\n}\n\nexport type FlatVector =
boolean[]|number[]|TypedArray;\nexport type RegularArray<T> =\n
T[]|T[][]|T[][][]|T[][][][]|T[][][][][]|T[][][][][];\n\n// tslint:disable-next-line:no-any\nexport interface
RecursiveArray<T extends any> {\n [index: number]: T|RecursiveArray<T>;\n}\n\n// Looks for upcasting types.
Used, for example, in operations with mixed dtype\n// inputs.\nenum UpcastInt32AndMap {\n 'float32' = 'float32',\n
'int32' = 'int32',\n 'bool' = 'int32',\n 'complex64' = 'complex64'\n}\n\nenum
UpcastBoolAndMap {\n 'float32' = 'float32',\n 'int32' = 'int32',\n 'bool' = 'bool',\n 'complex64' =
'complex64'\n}\n\nenum UpcastFloat32AndMap {\n 'float32' = 'float32',\n 'int32' = 'float32',\n 'bool' = 'float32',\n
'complex64' = 'complex64'\n}\n\nenum UpcastComplex64AndMap {\n 'float32' = 'complex64',\n 'int32' =
'complex64',\n 'bool' = 'complex64',\n 'complex64' = 'complex64'\n}\n\nconst upcastTypeMap = {\n 'float32':
UpcastFloat32AndMap,\n 'int32': UpcastInt32AndMap,\n 'bool': UpcastBoolAndMap,\n 'complex64':
UpcastComplex64AndMap\n};\n\nexport function upcastType(typeA: DataType, typeB: DataType): DataType {\n
if (typeA === 'string' || typeB === 'string') {\n if (typeA === 'string' && typeB === 'string') {\n return
'string';\n }\n throw new Error(`Can not upcast ${typeA} with ${typeB}`);\n }\n return
upcastTypeMap[typeA][typeB];\n}\n\n/** Returns the output type after summation. */\nexport function
sumOutType(type: DataType): DataType {\n return
upcastType(type, 'int32');\n}\n\n/** @docalias TypedArray|Array */\nexport type TensorLike =\n
TypedArray|number|boolean|string|RecursiveArray<number|number[]|TypedArray>|\n
RecursiveArray<boolean>|RecursiveArray<string>|Uint8Array[];\nexport type ScalarLike =
number|boolean|string|Uint8Array;\n\n/** @docalias TypedArray|Array */\nexport type TensorLike1D =
TypedArray|number[]|boolean[]|string[]|Uint8Array[];\n\n/** @docalias TypedArray|Array */\nexport type
TensorLike2D = TypedArray|number[]|number[][]|boolean[]|boolean[][]|\n
string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\nexport type TensorLike3D =
TypedArray|number[]|number[][]|boolean[]|\n
boolean[][]|string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\nexport type
TensorLike4D = TypedArray|number[]|number[][]|boolean[]|\n
boolean[][]|string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\nexport
type TensorLike5D =\n TypedArray|number[]|number[][]|boolean[]|boolean[][]|string[]|\n
string[][]|Uint8Array[]|Uint8Array[][];\n\n/** @docalias TypedArray|Array */\nexport type TensorLike6D
=\n TypedArray|number[]|number[][]|boolean[]|boolean[][]|\n
string[]|string[][]|Uint8Array[]|Uint8Array[][];\n\n/** Type for representing image data in Uint8Array
type. */\nexport interface PixelData {\n width: number;\n height: number;\n data: Uint8Array;\n}\n\n"/**\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n */

```

```

=====
*/\n\nimport {Tensor} from './tensor';\nimport {TensorContainer, TensorContainerArray} from
 './tensor_types';\nimport {upcastType} from './types';\nimport {assert} from './util';\n\nexport function
makeTypesMatch<T extends Tensor>(a: T, b: T): [T, T] {\n  if (a.dtype === b.dtype) {\n    return [a, b];\n  }\n  const dtype = upcastType(a.dtype, b.dtype);\n  return [a.cast(dtype), b.cast(dtype)];\n}\n\nexport function
assertTypesMatch(a: Tensor, b: Tensor): void {\n  assert(\n    a.dtype === b.dtype,\n    () => `The dtypes of the
first(${a.dtype}) and` +\n      ` second(${b.dtype}) input must match`);\n}\n\nexport function
isTensorInList(tensor: Tensor, tensorList: Tensor[]): boolean {\n  return tensorList.some(x => x.id ===
tensor.id);\n}\n\n/**\n  * Extracts any `Tensor`s found within the provided object.\n  * @param container an object that may be a
`Tensor` or may directly contain\n  * `Tensor`s, such as a `Tensor[]` or `{key: Tensor, ...}`. In general it\n  * is safe
to pass any object here, except that `Promise`s are not\n  * supported.\n  * @returns An array of `Tensors` found
within the passed object. If the\n  * argument is simply a `Tensor`, a list containing that `Tensor` is\n  * returned. If
the object is not a `Tensor` or does not\n  * contain `Tensors`, an empty list is returned.\n  */\n\nexport function
getTensorsInContainer(result: TensorContainer): Tensor[] {\n  const list: Tensor[] = [];\n  const seen = new
Set<{}|void>();\n  walkTensorContainer(result, list, seen);\n  return list;\n}\n\nfunction walkTensorContainer(\n
container: TensorContainer, list: Tensor[], seen: Set<{}|void>): void {\n  if (container == null) {\n    return;\n  }\n  if
(container instanceof Tensor) {\n    list.push(container);\n    return;\n  }\n  if (!Iterable(container)) {\n    return;\n  }\n  // Iteration over keys works also for arrays.\n  const
iterable = container as TensorContainerArray;\n  for (const k in iterable) {\n    const val = iterable[k];\n    if
(!seen.has(val)) {\n      seen.add(val);\n      walkTensorContainer(val, list, seen);\n    }\n  }\n}\n\n// tslint:disable-
next-line:no-any\nfunction isIterable(obj: any): boolean {\n  return Array.isArray(obj) || typeof obj ===
'object';\n}\n\n"/**\n  * @license\n  * Copyright 2018 Google LLC. All Rights Reserved.\n  * Licensed under the
Apache License, Version 2.0 (the "License");\n  * you may not use this file except in compliance with the
License.\n  * You may obtain a copy of the License at\n  * http://www.apache.org/licenses/LICENSE-2.0\n  * \n  * Unless required by applicable law or agreed to in writing, software\n  * distributed under the License is distributed
on an "AS IS" BASIS,\n  * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
or implied.\n  * See the License for the specific language governing permissions and\n  * limitations under the
License.\n  */
=====
*/\n\nimport {BackendTimingInfo, DataMover, KernelBackend} from './backends/backend';\nimport {Environment,
setEnvironmentGlobal} from './environment';\nimport {getGlobalNamespace} from './global_util';\nimport {Add,
Cast, Identity} from './kernel_names';\nimport {getGradient, getKernel, getKernelsForBackend, GradFunc,
NamedAttrMap, TensorInfo} from './kernel_registry';\nimport {KernelProfile, Profiler} from './profiler';\nimport
{backpropagateGradients, getFilteredNodesXToY, TapeNode} from './tape';\nimport {DataId, setTensorTracker,
Tensor, TensorTracker, Variable} from './tensor';\nimport {GradSaveFunc, NamedTensorMap, NamedVariableMap,
TensorContainer} from './tensor_types';\nimport {getTensorsInContainer} from './tensor_util';\nimport
{BackendValues, DataType, DataValues} from './types';\nimport
* as util from './util';\nimport {bytesFromStringArray, makeOnesTypedArray, now, sizeFromShape} from
 './util';\n\n/**\n  * A function that computes an output. The save function is for saving tensors\n  * computed in the
forward pass, that we need in the backward pass.\n  */\n\nexport type ForwardFunc<T> = (backend: KernelBackend,
save?: GradSaveFunc) => T;\n\n/**\n  * @docalias (a: Tensor, b: Tensor, ..., save?: Function) => {\n  *   value:
Tensor,\n  *   gradFunc: (dy: Tensor, saved?: NamedTensorMap) => Tensor | Tensor[]\n  * }\n  */\n\nexport type
CustomGradientFunc<T extends Tensor> = (\n  ...inputs: Array<Tensor|GradSaveFunc>) => {\n  value: T;\n  gradFunc: (dy: T, saved: Tensor[]) => Tensor | Tensor[];\n  };\n\nexport type MemoryInfo = {\n  numTensors:
number;\n  numDataBuffers: number;\n  numBytes: number;\n  unreliable?: boolean;\n  reasons: string[];\n};\n\nexport type
KernelInfo = {\n  name: string;\n  bytesAdded: number;\n  totalBytesSnapshot: number;\n  tensorsAdded: number;\n  totalTensorsSnapshot:
number;\n};

```

```

number;\n inputShapes: number[][];\n outputShapes: number[][];\n kernelTimeMs: number | {error: string} |
Promise<number>{error: string}>;\n extraInfo: string | Promise<string>;\n};\n\nexport type ProfileInfo = {\n
newBytes: number; newTensors: number; peakBytes: number;\n kernels: KernelInfo[];\n result:
TensorContainer;\n kernelNames: string[];\n};\n\nexport interface TimingInfo extends BackendTimingInfo {\n
wallMs: number;\n}\n\n/** @docalias Function */\nexport type ScopeFn<T extends TensorContainer> = () =>
T;\n\ninterface ScopeState {\n track: Tensor[];\n name: string;\n id: number;\n}\n\ninterface
RegisteredKernelInvocation<I extends NamedTensorMap> {\n kernelName: string;\n inputs: I;\n attrs?:
NamedAttrMap;\n}\n\ninterface CustomGradKernelInvocation<T extends Tensor|Tensor[],\n
I extends NamedTensorMap> {\n forwardFunc: ForwardFunc<T>;\n backwardsFunc: (dy: T, saved: Tensor[])
=> {\n [P in keyof
I]: () => I[P]\n }; \n inputs: I;\n attrs?: NamedAttrMap;\n}\n\nfunction isRegisteredKernelInvocation<T extends
Tensor|Tensor[],\n
I extends NamedTensorMap>(\n kernelInvocation:
RegisteredKernelInvocation<I>|\n CustomGradKernelInvocation<T, I>):\n kernelInvocation is
RegisteredKernelInvocation<I> {\n return (kernelInvocation as RegisteredKernelInvocation<I>).kernelName !=
null;\n}\n\nnclass EngineState {\n // Public since optimizers will use it.\n registeredVariables: NamedVariableMap
= {};\n\n nextTapeNodeId = 0;\n numBytes = 0;\n numTensors = 0;\n numStringTensors = 0;\n numDataBuffers
= 0;\n\n activeTape: TapeNode[];\n // Number of nested tf.grad() statements when computing higher-order\n //
gradients. E.g. `1` for first-order gradients and `2` for second-order\n // gradients. Used to track if the tape should be
removed after a backprop.\n gradientDepth = 0;\n // Number of nested kernel calls. When kernel depth
is greater than 1, we turn\n // off the tape.\n kernelDepth = 0;\n // Keep Tensors that parallel the tapes.\n
activeScope: ScopeState;\n scopeStack: ScopeState[] = [];\n /**\n * Keeps track of the number of data moves
during a kernel execution. We\n * maintain a stack since kernels can call other kernels, recursively.\n */\n
numDataMovesStack: number[] = [];\n nextScopeId = 0;\n\n tensorInfo = new WeakMap<DataId, {\n backend:
KernelBackend,\n bytes: number,\n dtype: DataType,\n shape: number[]\n }>();\n\n profiling = false;\n
activeProfile: ProfileInfo = {\n newBytes: 0,\n newTensors: 0,\n peakBytes: 0,\n kernels: [],\n result:
null,\n get kernelNames():\n string[] {\n return Array.from(new Set(this.kernels.map(k => k.name))); \n
}\n }; \n\n dispose() {\n for (const variableName in this.registeredVariables) {\n
this.registeredVariables[variableName].dispose(); \n } \n }\n}\n\nexport class Engine implements
TensorTracker, DataMover {\n state: EngineState;\n backendName: string;\n registry: {[id: string]:
KernelBackend} = {};\n registryFactory: {\n [id: string]: {\n factory: () => KernelBackend |
Promise<KernelBackend>,\n priority: number\n } \n } = {};\n\n private profiler: Profiler;\n private
backendInstance: KernelBackend;\n private pendingBackendInit: Promise<boolean>;\n private
pendingBackendInitId = 0;\n\n constructor(public ENV: Environment) {\n this.state = new EngineState(); \n }\n\n
async ready(): Promise<void> {\n if (this.pendingBackendInit != null) {\n return
this.pendingBackendInit.then(() => {});\n } \n if (this.backendInstance != null) {\n return;\n } \n const
sortedBackends = this.getSortedBackends();\n\n for (let i = 0; i < sortedBackends.length; i++) {\n const
backendName = sortedBackends[i];\n const success = await this.initializeBackend(backendName).success;\n
if (success) {\n await this.setBackend(backendName);\n
return;\n } \n }\n\n throw new Error(\n `Could not initialize any backends, all backend initializations
` +\n `failed.`);\n }\n\n get backend(): KernelBackend {\n if (this.pendingBackendInit != null) {\n throw
new Error(\n `Backend '${this.backendName}' has not yet been initialized. Make ` +\n `sure to await
tf.ready() or await tf.setBackend() before calling ` +\n `other methods`);\n } \n if (this.backendInstance ==
null) {\n const {name, asyncInit} = this.initializeBackendsAndReturnBest();\n if (asyncInit) {\n throw
new Error(\n `The highest priority backend '${name}' has not yet been ` +\n `initialized. Make sure to
await tf.ready() or ` +\n `await tf.setBackend() before calling other methods`);\n } \n
this.setBackend(name);\n } \n return this.backendInstance;\n }\n\n backendNames(): string[] {\n return
Object.keys(this.registryFactory);\n

```

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    }\n\n findBackend(backendName: string): KernelBackend {\n  if (!(backendName in this.registry)) {\n    // If
the backend hasn't been initialized but we have a registry entry for\n    // it, initialize it and return it.\n    if
(backendName in this.registryFactory) {\n      const {asyncInit} = this.initializeBackend(backendName);\n      if
(asyncInit) {\n        // Backend is not ready yet.\n        return null;\n      }\n    } else {\n      return null;\n    }\n  }\n  return this.registry[backendName];\n}\n\n findBackendFactory(backendName: string):\n  () =>
KernelBackend | Promise<KernelBackend> {\n  if (!(backendName in this.registryFactory)) {\n    return null;\n  }\n  return this.registryFactory[backendName].factory;\n}\n\n registerBackend(\n  backendName: string,\n  factory: () => KernelBackend | Promise<KernelBackend>,\n  priority = 1): boolean {\n  if (backendName in
this.registryFactory) {\n    console.warn(\n      `${backendName} backend was already registered.` +\n      `Reusing existing backend
factory.`);\n    return false;\n  }\n  this.registryFactory[backendName] = {factory, priority};\n  return true;\n}\n\n async setBackend(backendName: string): Promise<boolean> {\n  if (this.registryFactory[backendName] ==
null) {\n    throw new Error(`Backend name '${backendName}' not found in registry`);\n  }\n  this.backendName
= backendName;\n  if (this.registry[backendName] == null) {\n    this.backendInstance = null;\n    const
{success, asyncInit} = this.initializeBackend(backendName);\n    const result = asyncInit ? await success :
success;\n    if (!result) {\n      return false;\n    }\n  }\n  this.backendInstance = this.registry[backendName];\n  this.setupRegisteredKernels();\n  // Reset the profiler.\n  this.profiler = new Profiler(this.backendInstance);\n  return true;\n}\n\n private setupRegisteredKernels():
void {\n  const kernels = getKernelsForBackend(this.backendName);\n  kernels.forEach(kernel => {\n    if
(kernel.setupFunc != null) {\n      kernel.setupFunc(this.backendInstance);\n    }\n  });\n}\n\n private
disposeRegisteredKernels(backendName: string): void {\n  const kernels =
getKernelsForBackend(backendName);\n  kernels.forEach(kernel => {\n    if (kernel.disposeFunc != null) {\n
kernel.disposeFunc(this.registry[backendName]);\n    }\n  });\n}\n\n /**\n * Initializes a backend by looking
up the backend name in the factory\n * registry and calling the factory method. Returns a boolean representing\n *
whether the initialization of the backend succeeded. Throws an error if\n * there is no backend in the factory
registry.\n */\n private initializeBackend(backendName: string):\n  {success: boolean|Promise<boolean>,\n  asyncInit: boolean} {\n  const registryFactoryEntry = this.registryFactory[backendName];\n  if
(registryFactoryEntry
== null) {\n    throw new Error(\n      `Cannot initialize backend ${backendName}, no registration found.`);\n  }\n}\n\n try {\n  const backend = registryFactoryEntry.factory();\n  /* Test if the factory returns a promise.\n  Done in a more liberal way than\n  previous 'Promise.resolve(backend)===backend'\n  as we needed to account
for custom Promise\n  implementations (e.g. Angular) */\n  if (backend && !(backend instanceof
KernelBackend) &&\n    typeof backend.then === 'function') {\n    const promiseId =
++this.pendingBackendInitId;\n    const success =\n      backend\n      .then(backendInstance => {\n
// Outdated promise. Another backend was set in the meantime.\n      if (promiseId <
this.pendingBackendInitId) {\n        return false;\n      }\n      this.registry[backendName] =
backendInstance;\n      this.pendingBackendInit = null;\n      return true;\n    })\n    .catch(err => {\n      // Outdated promise. Another backend
was set in the meantime.\n      if (promiseId < this.pendingBackendInitId) {\n        return false;\n      }\n      this.pendingBackendInit = null;\n      console.warn(\n        `Initialization of
backend ${backendName} failed`);\n      console.warn(err.stack || err.message);\n      return false;\n    });\n    this.pendingBackendInit = success;\n    return {success, asyncInit: true};\n  } else {\n    this.registry[backendName] = backend as KernelBackend;\n    return {success: true, asyncInit: false};\n  }\n}\n\n catch (err) {\n  console.warn(`Initialization of backend ${backendName} failed`);\n  console.warn(err.stack ||
err.message);\n  return {success: false, asyncInit: false};\n}\n}\n\n removeBackend(backendName:
string): void {\n  if (!(backendName in this.registryFactory)) {\n    throw new Error(`${backendName} backend
not found in registry`);\n  }\n  if (this.backendName === backendName && this.pendingBackendInit != null) {\n
// There is a pending promise of the backend we want to remove. Make it\n    // obsolete.\n

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this.pendingBackendInitId++;
}

if (backendName in this.registry) {
this.disposeRegisteredKernels(backendName);
this.registry[backendName].dispose();
delete
this.registry[backendName];
}

delete this.registryFactory[backendName];
// Unset the backend if it is
active.
if (this.backendName === backendName) {
this.pendingBackendInit = null;
this.backendName
= null;
this.backendInstance = null;
}

private getSortedBackends(): string[] {
if
(Object.keys(this.registryFactory).length === 0) {
throw new Error('No backend found in registry.');
```

return Object.keys(this.registryFactory).sort((a: string, b: string) => {
// Highest priority comes first.
return this.registryFactory[b].priority - this.registryFactory[a].priority;
});

private initializeBackendsAndReturnBest(): {name: string, asyncInit: boolean} {
const sortedBackends = this.getSortedBackends();
for (let i = 0; i < sortedBackends.length; i++) {
const backendName = sortedBackends[i];
const {success, asyncInit} = this.initializeBackend(backendName);
if (asyncInit || success) {
return {name: backendName, asyncInit};
}
}
throw new Error(`Could not initialize any backends, all backend initializations ` + `failed.`);

moveData(backend: KernelBackend, dataId: DataId) {
const info = this.state.tensorInfo.get(dataId);
const srcBackend = info.backend;
const values = this.readSync(dataId);
const refCount = srcBackend.refCount(dataId);

// Delete the tensor from the old backend and move it to the new
// backend.
srcBackend.disposeData(dataId, true);
info.backend = backend;
backend.move(dataId, values, info.shape, info.dtype, refCount);
if (this.shouldCheckForMemLeaks()) {
// Track the number of moves during a kernel execution to correctly
// detect memory leaks.
this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1]++;
}

tidy<T extends TensorContainer>(nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>): T {
let name: string = null;
if (fn == null) {
// Called with only 1 argument.
if (typeof nameOrFn !== 'function') {
throw new Error('Please provide a function to tidy()');

fn = nameOrFn;
} else {
// Called with 2 arguments.
if (typeof nameOrFn !== 'string' && !(nameOrFn instanceof String)) {
throw new Error(`When calling with two arguments, the first argument ` + `to tidy() must be a string`);

if (typeof fn !== 'function') {
throw new Error(`When calling with two arguments, the 2nd argument ` + `to tidy() must be a function`);

name = nameOrFn as string;
// TODO(nsthorat,smilkov): Do operation logging and performance
// profiling.
}
let result: T;
return this.scopedRun(() => this.startScope(name), () => this.endScope(result), () => {
result = fn();
if (result instanceof Promise) {
console.error('Cannot return a Promise inside of tidy.');

return result;
});
}
private scopedRun<T>(start: () => void, end: () => void, f: () => T): T {
start();
try {
const res = f();
end();
return res;
} catch (ex) {
end();
throw ex;
}
}

private static nextTensorId = 0;
private nextTensorId(): number {
return Engine.nextTensorId++;
}

private static nextVariableId = 0;
private nextVariableId(): number {
return Engine.nextVariableId++;
}

/**
 * This method is called instead of the public-facing tensor.clone() when
 * saving a tensor for backwards pass. It makes sure to add the clone
 * operation to the tape regardless of being called inside a kernel
 * execution.
 */
private clone(x: Tensor): Tensor {
const y: Tensor = ENGINE.runKernel(Identity, {x} as {} as NamedTensorMap);
const inputs = {x};
const grad = (dy: Tensor) => ({
x: () => {
const dtype = 'float32';
const gradInputs = {x: dy};
const attrs = {dtype};
return ENGINE.runKernel(Cast, gradInputs as {} as NamedTensorMap,
// tslint:disable-next-line: no-unnecessary-type-assertion
attrs as {} as NamedAttrMap) as Tensor;
});
const saved: Tensor[] = [];
this.addTapeNode(this.state.activeScope.name, inputs, [y], grad, saved, {});
return y;
}

/**
 * Execute a kernel with the given name and return the output tensor.
 * @param kernelName The name of the kernel to execute.
 * @param inputs A map of input names to tensors.
 * @param attrs A map of attribute names to their values. An attribute is
 * a primitive (non-tensor) input to the kernel.
 * @param inputsToSave A list of tensors, inputs to save for the backprop
 * computation.
 * @param outputsToSave A

```

list of booleans, specifying which output to save\n * for the backprop computation. These are booleans since the
output\n * tensors are not visible to the user.\n */\n runKernel<T extends Tensor|Tensor[]>(\n kernelName:
string, inputs: NamedTensorMap, attrs?: NamedAttrMap): T {\n const hasKernel = getKernel(kernelName,
this.backendName) != null;\n if (!hasKernel) {\n throw new Error(`Kernel
'${kernelName}' not registered for backend '${\n this.backendName}');\n }\n return
this.runKernelFunc({kernelName, inputs, attrs});\n }\n\n private shouldCheckForMemLeaks(): boolean {\n
return this.ENV.getBool('IS_TEST');\n }\n\n private checkKernelForMemLeak(\n kernelName: string,
numDataIdsBefore: number,\n outInfos: TensorInfo[]): void {\n const numDataIdsAfter =
this.backend.numDataIds();\n // Count the number of data ids associated with the result of the kernel.\n let
numOutputDataIds = 0;\n outInfos.forEach(info => {\n // Complex numbers allocate 3 data ids, one for 'real',
one for\n // 'imaginary', and one for the container that holds the former two.\n numOutputDataIds +=
(info.dtype === 'complex64' ? 3 : 1);\n });\n\n // Account for the number of moves during kernel execution. A
\data move"\n // can happen in the middle of a kernel execution, placing a new (key,value)\n // pair in the data
storage.

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Since data moves have net zero effect (we\n // always remove the data from the old backend), we have to cancel
them out\n // when detecting memory leaks.\n const numMoves =\n this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1];\n const dataIdsLeaked =\n numDataIdsAfter - numDataIdsBefore - numOutputDataIds - numMoves;\n if (dataIdsLeaked > 0) {\n throw
new Error(\n `Backend '${this.backendName}' has an internal memory leak ` +\n ` (${dataIdsLeaked}
data ids) after running '${kernelName}');\n }\n }\n\n /**\n * Internal helper method to execute a kernel Func\n
*\n * Use `runKernel` to execute kernels from outside of engine.\n */\n private runKernelFunc<T extends
Tensor|Tensor[], I extends NamedTensorMap>(\n kernelParams: RegisteredKernelInvocation<I>|\n
CustomGradKernelInvocation<T, I>): T {\n let outputs: Tensor[];\n let saved: Tensor[] = [];\n const isTapeOn
= this.isTapeOn();\n\n

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const startingBytecount = this.state.numBytes;\n const startingNumTensors = this.state.numTensors;\n\n if
(this.shouldCheckForMemLeaks()) {\n this.state.numDataMovesStack.push(0);\n }\n\n let kernelFunc: () =>
Tensor[];\n if (this.backendName == null) {\n // backend has not been initialized yet (backend initialization is
lazy\n // can be deferred until an op/ kernel is run).\n // The below getter has side effects that will try to
initialize the\n // backend and set properties like this.backendName\n // tslint:disable-next-line: no-unused-
expression\n this.backend;\n }\n\n let out: TensorInfo|TensorInfo[];\n const kernelOrScopeName =
isRegisteredKernelInvocation(kernelParams) ?\n kernelParams.kernelName :\n this.state.activeScope !=
null ? this.state.activeScope.name : "";\n // Create the kernelFunc from either a registered kernel OR passed in\n
// forward/backward functions (used by custom grad). In

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this context a\n // kernelFunc wraps a kernel implementation with some bookkeeping.\n\n if
(isRegisteredKernelInvocation(kernelParams)) {\n const {kernelName, inputs, attrs} = kernelParams;\n if
(this.backendName == null) {\n // backend has not been initialized yet (backend initialization is lazy\n //
can be deferred until an op/ kernel is run).\n // The below getter has side effects that will try to initialize the\n
// backend and set properties like this.backendName\n // tslint:disable-next-line: no-unused-expression\n
this.backend;\n }\n const kernel = getKernel(kernelName, this.backendName);\n util.assert(\n kernel
!= null,\n () => `Cannot find registered kernel '${kernelName}' for backend '${\n
this.backendName}');\n\n kernelFunc = () => {\n const numDataIdsBefore = this.backend.numDataIds();\n
out = kernel.kernelFunc({inputs, attrs, backend: this.backend});\n

```

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const outInfos = Array.isArray(out) ? out : [out];\n if (this.shouldCheckForMemLeaks()) {\n
this.checkKernelForMemLeak(kernelName, numDataIdsBefore, outInfos);\n }\n\n const outTensors =
outInfos.map((outInfo: TensorInfo|Tensor) => {\n // todo (yassogba) remove this option (Tensor) when node
backend\n // methods have been modularized and they all return tensorInfo.\n // TensorInfos do not have
a rank attribute.\n if ((outInfo as Tensor).rank != null) {\n return outInfo as Tensor;\n }\n\n const {dataId, shape, dtype} = outInfo as TensorInfo;\n return this.makeTensorFromDataId(dataId, shape,

```



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dtype);\n    });\n\n    // Save any required inputs and outputs.\n\n    // Do not save unless we are recording to
the tape. Otherwise it would\n    // cause a mem leak since there would be no backprop for these tensors\n    //
(which would otherwise dispose them).\n
    if (isTapeOn) {\n        const tensorsToSave =\n            this.getTensorsForGradient(kernelName, inputs,
outTensors);\n        saved = this.saveTensorsForBackwardMode(tensorsToSave);\n    }\n    return
outTensors;\n    };\n    } else {\n        const {forwardFunc} = kernelParams;\n        // Running a customGrad op.\n
const saveFunc: GradSaveFunc = (tensors) => {\n            // Do not save unless we are recording to the tape. Otherwise
it would\n            // cause a mem leak since we would never run backprop, which disposes\n            // the kept tensors.\n
            if (!isTapeOn) {\n                return;\n            }\n            saved = tensors.map(tensor => this.keep(this.clone(tensor)));\n
        };\n\n        kernelFunc = () => {\n            const numDataIdsBefore = this.backend.numDataIds();\n            out = this.tidy(()
=> forwardFunc(this.backend, saveFunc));\n            const outs = (Array.isArray(out) ? out : [out]) as Tensor[];\n            if
(this.shouldCheckForMemLeaks()) {\n
                // Scope name is used to print a more helpful error message if needed.\n
                this.checkKernelForMemLeak(kernelOrScopeName, numDataIdsBefore, outs);\n            }\n            return outs;\n        };\n
    }\n\n    // Run the kernelFunc. Optionally profiling it.\n    //\n    const {inputs, attrs} = kernelParams;\n    const
backwardsFunc = isRegisteredKernelInvocation(kernelParams) ?\n        null : \n
kernelParams.backwardsFunc;\n\n    let kernelProfile: KernelProfile;\n    this.scopedRun(\n        // Stop recording to
a tape when running a kernel.\n        () => this.state.kernelDepth++, () => this.state.kernelDepth--, () => {\n            if
(!this.ENV.getBool('DEBUG') && !this.state.profiling) {\n                outputs = kernelFunc();\n            } else {\n
                kernelProfile = this.profiler.profileKernel(\n                    kernelOrScopeName, inputs, () => kernelFunc());\n                if
(this.ENV.getBool('DEBUG')) {\n                    this.profiler.logKernelProfile(kernelProfile);\n                }\n                outputs = kernelProfile.outputs;\n            }\n        });\n\n    if (isTapeOn) {\n
        this.addTapeNode(\n            kernelOrScopeName, inputs, outputs, backwardsFunc, saved, attrs);\n    }\n\n    if
(this.state.profiling) {\n        this.state.activeProfile.kernels.push({\n            name: kernelOrScopeName,\n
            bytesAdded: this.state.numBytes - startingBytecount,\n            totalBytesSnapshot: this.state.numBytes,\n
            tensorsAdded: this.state.numTensors - startingNumTensors,\n            totalTensorsSnapshot: this.state.numTensors,\n
            inputShapes: Object.keys(inputs).map(\n                key => inputs[key] != null ? inputs[key].shape : null),\n
            outputShapes: outputs.map(item => item.shape),\n            kernelTimeMs: kernelProfile.timeMs,\n            extraInfo:
kernelProfile.extraInfo\n        });\n    }\n    return (Array.isArray(out) ? outputs : outputs[0]) as T;\n    }\n\n    /**\n     *
Saves tensors used in forward mode for use in backward mode.\n     */\n
    * @param tensors the list of tensors to save.\n     */\n    private saveTensorsForBackwardMode(tensors: Tensor[]):
Tensor[] {\n        const saved = tensors.map(tensor => this.keep(this.clone(tensor)));\n        return saved;\n    }\n\n    /**\n     *
Returns a list of tensors to save for a given gradient calculation.\n     */\n    * @param kernelName name of kernel to
look up gradient for.\n    * @param inputs a map of input tensors.\n    * @param outputs an array of output tensors
from forward mode of kernel.\n     */\n    private getTensorsForGradient(\n        kernelName: string, inputs:
NamedTensorMap,\n        outputs: Tensor[]): Tensor[]|null {\n        const gradConfig = getGradient(kernelName);\n        if
(gradConfig != null) {\n            const inputsToSave: string[] = gradConfig.inputsToSave || [];\n            const outputsToSave:
boolean[] = gradConfig.outputsToSave || [];\n\n            // If saveAllInputs is true, all inputs will be saved. Otherwise,
inputs\n            // specified in inputsToSave will be saved.\n            let inputTensorsToSave:
Tensor[];\n            if (gradConfig.saveAllInputs) {\n                util.assert(\n                    Array.isArray(inputs),\n                    () =>
'saveAllInputs is true, expected inputs to be an array.);\n\n                inputTensorsToSave =
Object.keys(inputs).map((key) => inputs[key]);\n            } else {\n                inputTensorsToSave =
inputsToSave.map((inputName) => inputs[inputName]);\n            }\n\n            const outputTensorsToSave: Tensor[] =\n                outputs.filter((_, i) => outputsToSave[i]);\n\n            return inputTensorsToSave.concat(outputTensorsToSave);\n        }\n\n        // We return an empty list rather than throw an error because the kernel we\n        // are looking up may not actually be
relevant to backpropping through the\n        // overall function\n        //\n        // See 'does not error if irrelevant (pruned) ops
are missing grads' test\n        // in gradients_test.ts for an example.\n        return [];\n    }\n\n    /**\n     * Internal method used
by public APIs for tensor creation. Makes a new\n     */\n    * tensor with

```

```

the provided shape, dtype and values. It always
 * creates a new data id and writes the values to the underlying
backend.
 *
makeTensor(values: DataValues, shape: number[], dtype: DataType,
backend?:
KernelBackend): Tensor {
  if (values == null) {
    throw new Error('Values passed to engine.makeTensor() are
null');
  }
  dtype = dtype || 'float32';
  backend = backend || this.backend;
  let backendVals = values as
BackendValues;
  if (dtype === 'string' && util.isString(values[0])) {
    backendVals = (values as
string[]).map(d => util.encodeString(d));
  }
  const dataId = backend.write(backendVals, shape, dtype);
  const t = new Tensor(shape, dtype, dataId, this.nextTensorId());
  this.trackTensor(t, backend);
  // Count
bytes for string tensors.
  if (dtype === 'string') {
    const info = this.state.tensorInfo.get(dataId);
    const
newBytes = bytesFromStringArray(backendVals as Uint8Array[]);
    this.state.numBytes
    += newBytes - info.bytes;
    info.bytes = newBytes;
  }
  return t;
}
/**
 * Internal method used by
backends. Makes a new tensor
 * that is a wrapper around an existing data id. It doesn't create
 * a new data id,
only increments the ref count used in memory tracking.
 *
makeTensorFromDataId(dataId: DataId,
shape: number[], dtype: DataType,
backend?: KernelBackend): Tensor {
  dtype = dtype || 'float32';
  const
t = new Tensor(shape, dtype, dataId, this.nextTensorId());
  this.trackTensor(t, backend);
  return t;
}
makeVariable(initialValue: Tensor, trainable = true, name?: string,
dtype?: DataType): Variable {
  name = name || this.nextVariableId().toString();
  if (dtype != null && dtype !== initialValue.dtype) {
    initialValue = initialValue.cast(dtype);
  }
  const v = new Variable(initialValue, trainable, name,
this.nextTensorId());
  if (this.state.registeredVariables[v.name]
  != null) {
    throw new Error('Variable with name ${v.name} was already registered');
  }
  this.state.registeredVariables[v.name] = v;
  this.incRef(v, this.backend);
  return v;
}
trackTensor(a:
Tensor, backend: KernelBackend): void {
  this.state.numTensors++;
  if (a.dtype === 'string') {
    this.state.numStringTensors++;
  }
  // Bytes for complex numbers are counted by their components. Bytes for
// string tensors are counted when writing values.
  let bytes = 0;
  if (a.dtype !== 'complex64' && a.dtype !==
'string') {
    bytes = a.size * util.bytesPerElement(a.dtype);
  }
  this.state.numBytes += bytes;
  if
(!this.state.tensorInfo.has(a.dataId)) {
    this.state.numDataBuffers++;
    this.state.tensorInfo.set(a.dataId, {
      backend: backend || this.backend,
      dtype: a.dtype,
      shape: a.shape,
      bytes
    });
  }
  if
(!(a instanceof Variable)) {
    this.track(a);
  }
}
}
// Track the tensor by dataId and increase the refCount for the dataId in the
// backend.
//
TODO(pyu10055): This is currently used by makeVariable method, to increase
// refCount on the backend for the
dataId. It can potentially be replaced with
// Identity op inead of calling backend directly.
incRef(a: Tensor,
backend: KernelBackend): void {
  this.trackTensor(a, backend);
  this.backend.incRef(a.dataId);
}
removeDataId(dataId: DataId, backend: KernelBackend) {
  if (this.state.tensorInfo.has(dataId) &&
this.state.tensorInfo.get(dataId).backend === backend) {
    this.state.tensorInfo.delete(dataId);
    this.state.numDataBuffers--;
  }
}
disposeTensor(a: Tensor): void {
  if
(!this.state.tensorInfo.has(a.dataId)) {
    return;
  }
  const info = this.state.tensorInfo.get(a.dataId);
  this.state.numTensors--;
  if (a.dtype === 'string') {
    this.state.numStringTensors--;
    this.state.numBytes -= info.bytes;
  }
  // Don't count bytes for complex numbers as they are counted by
their
// components.
  if (a.dtype !== 'complex64' && a.dtype !== 'string') {
    const bytes = a.size *
util.bytesPerElement(a.dtype);
    this.state.numBytes -= bytes;
  }
  // Remove the reference to dataId if
backend dispose the data successfully
  if (info.backend.disposeData(a.dataId)) {
    this.removeDataId(a.dataId, info.backend);
  }
  // TODO(nsthorat): Construct an error and save the stack
trace for
// debugging when in debug mode. Creating a stack trace is too expensive
// to do unconditionally.
}
disposeVariables(): void {
  for (const varName in this.state.registeredVariables) {
    const v =
this.state.registeredVariables[varName];
    this.disposeVariable(v);
  }
}
disposeVariable(v: Variable):
void {
  this.disposeTensor(v);
  if (this.state.registeredVariables[v.name] != null) {
    delete this.state.registeredVariables[v.name];
  }
}
memory(): MemoryInfo {
  const info =
this.backend.memory() as MemoryInfo;
  info.numTensors = this.state.numTensors;
  info.numDataBuffers =
this.state.numDataBuffers;
  info.numBytes = this.state.numBytes;
  if (this.state.numStringTensors > 0) {

```

```

info.unreliable = true;\n    if (info.reasons === null) {\n        info.reasons = [];\n    }\n    info.reasons.push(\n
'Memory usage by string tensors is approximate ' +\n        '(2 bytes per character)');\n    }\n    return info;\n }\n\n
async profile(query: () => (TensorContainer | Promise<TensorContainer>)):\n    Promise<ProfileInfo> {\n
this.state.profiling = true;\n\n    const startBytes = this.state.numBytes;\n    const startNumTensors =
this.state.numTensors;\n\n    this.state.activeProfile.kernels = [];\n    this.state.activeProfile.result = await
query();\n\n    this.state.profiling = false;\n\n    this.state.activeProfile.peakBytes
= Math.max(\n        ...this.state.activeProfile.kernels.map(d => d.totalBytesSnapshot);\n
this.state.activeProfile.newBytes = this.state.numBytes - startBytes;\n    this.state.activeProfile.newTensors =\n
this.state.numTensors - startNumTensors;\n    for (const kernel of this.state.activeProfile.kernels) {\n
kernel.kernelTimeMs = await kernel.kernelTimeMs;\n    kernel.extraInfo = await kernel.extraInfo;\n    }\n    return
this.state.activeProfile;\n }\n\n isTapeOn(): boolean {\n    return this.state.gradientDepth > 0 &&
this.state.kernelDepth === 0;\n }\n\n private addTapeNode(\n    kernelName: string, inputs: NamedTensorMap,
outputs: Tensor[],\n    gradientsFunc: GradFunc, saved: Tensor[], attrs: NamedAttrMap): void {\n    const
tapeNode: TapeNode =\n        {id: this.state.nextTapeNodeId++, kernelName, inputs, outputs, saved};\n\n    const
gradConfig = getGradient(kernelName);\n    if (gradConfig != null) {\n        gradientsFunc = gradConfig.gradFunc;\n
    }\n    if (gradientsFunc != null) {\n        tapeNode.gradient = (dys: Tensor[]) => {\n            // TODO(smilkov): To
optimize back-prop, pass dys that are not used in\n            // the backprop graph to the user as null instead of zeros\n
dys = dys.map((dy, i) => {\n                if (dy == null) {\n                    const output = outputs[i];\n                    const vals =
util.makeZerosTypedArray(output.size, output.dtype);\n                    return this.makeTensor(vals, output.shape,
output.dtype);\n                }\n                return dy;\n            });\n            // Grad functions of ops with single outputs expect a dy,
while ops\n            // with multiple outputs expect dys (array of dy).\n            return gradientsFunc(dys.length > 1 ? dys :
dys[0], saved, attrs);\n        }; \n    }\n    this.state.activeTape.push(tapeNode);\n }\n\n keep<T extends
Tensor>(result: T): T {\n    result.kept = true;\n    return result;\n }\n\n private startTape() {\n    if
(this.state.gradientDepth === 0) {\n
        this.state.activeTape = [];\n    }\n    this.state.gradientDepth++;\n }\n\n private endTape() {\n
this.state.gradientDepth--;\n }\n\n /**\n * Start a scope. Use this with endScope() to achieve the same
functionality\n * as scope() without the need for a function closure.\n */\n startScope(name?: string) {\n    const
scopeInfo: ScopeState = {\n        track: [],\n        name: 'unnamed scope',\n        id: this.state.nextScopeId++\n    }; \n    if
(name) {\n        scopeInfo.name = name;\n    }\n    this.state.scopeStack.push(scopeInfo);\n    this.state.activeScope =
scopeInfo;\n }\n\n /**\n * End a scope. Use this with startScope() to achieve the same functionality\n * as
scope() without the need for a function closure.\n */\n endScope(result?: TensorContainer) {\n    const
tensorsToTrackInParent = getTensorsInContainer(result);\n    const tensorsToTrackInParentSet =\n        new
Set(tensorsToTrackInParent.map(t => t.id));\n\n    // Dispose the arrays tracked in this
scope.\n    for (let i = 0; i < this.state.activeScope.track.length; i++) {\n        const tensor =
this.state.activeScope.track[i];\n        if (!tensor.kept && !tensorsToTrackInParentSet.has(tensor.id)) {\n
tensor.dispose();\n        }\n    }\n\n    const oldScope = this.state.scopeStack.pop();\n    this.state.activeScope =
this.state.scopeStack.length === 0 ?\n        null :\n        this.state.scopeStack[this.state.scopeStack.length - 1];\n\n    //
Track the current result in the parent scope.\n    tensorsToTrackInParent.forEach(tensor => {\n        // Only track the
tensor if it was allocated in the inner scope and is not\n        // globally kept.\n        if (!tensor.kept && tensor.scopeId
=== oldScope.id) {\n            this.track(tensor);\n        }\n    });\n }\n\n /**\n * Returns gradients of `f` with respect to
each of the `xs`. The gradients\n * returned are of the same length as `xs`, but some might be null if `f`\n * was
not a function of that `x`. It also takes optional dy
to multiply the\n * gradient, which defaults to `1`.\n */\n gradients<T extends Tensor>(\n    f: () => T, xs:
Tensor[], dy?: T,\n    allowNoGradients = false): {value: T, grads: Tensor[]} {\n    util.assert(\n        xs.length > 0,
() => 'gradients() received an empty list of xs.);\n    if (dy != null && dy.dtype !== 'float32') {\n        throw new
Error(`dy must have 'float32' dtype, but has '${dy.dtype}'`);\n    }\n\n    const y = this.scopedRun(\n        () =>
this.startTape(), () => this.endTape(),\n        () => this.tidy('forward', f));\n\n    util.assert(\n        y instanceof
Tensor,\n        () => 'The result y returned by f() must be a tensor.);\n    // Filter out the nodes that don't connect x =>

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y.\n  const filteredTape = getFilteredNodesXToY(this.state.activeTape, xs, y);\n  if (!allowNoGradients &&\n  filteredTape.length === 0 && xs.length > 0) {\n    throw new Error(\n      'Cannot compute gradient of y=f(x)\n  with respect to x. Make sure '+\n    'that\n  the f you passed encloses all operations that lead from x '+\n    'to y.);\n  }\n  return this.tidy('backward', ()\n=> {\n    const accumulatedGradientMap: {[tensorId: number]: Tensor} = {};\n    accumulatedGradientMap[y.id]\n  = (dy == null) ? ones(y.shape) : dy;\n    // Backprop gradients through the filtered nodes.\n  backpropagateGradients(\n    accumulatedGradientMap, filteredTape,\n    // Pass the tidy function to avoid\n  circular dep with `tape.ts`.\n    f => this.tidy(f as ScopeFn<Tensor>),\n    // Pass an add function to avoid a\n  circular dep with `tape.ts`.\n    add);\n    const grads = xs.map(x => accumulatedGradientMap[x.id]);\n    if\n  (this.state.gradientDepth === 0) {\n    // This means that we are not computing higher-order gradients\n    // and\n  can clean up the tape.\n    this.state.activeTape.forEach(node => {\n      for (const tensor of node.saved) {\n        tensor.dispose();\n      }\n    });\n    this.state.activeTape = null;\n  }\n  return {value: y, grads};\n});\n}\n\n customGrad<T\n  extends Tensor>(f: CustomGradientFunc<T>):\n  (...args: Array<Tensor|GradSaveFunc>) => T {\n  util.assert(\n    util.isFunction(f),\n    () => 'The f passed in customGrad(f) must be a function.);\n  return (...inputs:\n  Tensor[]): T => {\n    util.assert(\n      inputs.every(t => t instanceof Tensor),\n      () => 'The args passed in\n  customGrad(f)(x1, x2,...) must all be '+\n      'tensors');\n    let res: {\n      value: T,\n      gradFunc: (dy: T,\n  saved: Tensor[]) => Tensor | Tensor[],\n    }; \n    const inputMap: NamedTensorMap = {};\n    inputs.forEach((input, i) => {\n      inputMap[i] = input;\n    });\n    const forwardFunc: ForwardFunc<T> = (\n  save) => {\n      res = f(...inputs, save);\n      util.assert(\n        res.value instanceof Tensor,\n        () =>\n      'The function f passed in\n  customGrad(f) must return an '+\n      'object where `obj.value` is a tensor');\n      util.assert(\n        util.isFunction(res.gradFunc),\n        () => 'The function f passed in customGrad(f) must return an '+\n      'object where `obj.gradFunc` is a function.);\n      return res.value;\n    }; \n    const backwardsFunc = (dy: T,\n  saved: Tensor[]) => {\n      const gradRes = res.gradFunc(dy, saved);\n      const grads: Tensor[] =\n      Array.isArray(gradRes) ? gradRes : [gradRes];\n      util.assert(\n        grads.length === inputs.length,\n        ()\n      => 'The function f passed in customGrad(f) must return an '+\n      'object where `obj.gradFunc` is a function\n  that returns '+\n      'the same number of tensors as inputs passed to f(...).);\n      util.assert(\n        grads.every(t => t instanceof Tensor),\n        () => 'The function f passed in customGrad(f) must return an '+\n      'object\n  where `obj.gradFunc` is a function that returns '+\n      'a list of only tensors.);\n      const gradMap: {[key:\n  string]: () => Tensor} = {};\n      grads.forEach((grad, i) => {\n        gradMap[i] = () => grad;\n      });\n      return gradMap;\n    }; \n    return this.runKernelFunc({\n      forwardFunc,\n      backwardsFunc,\n      inputs: inputMap,\n    });\n  }\n  readSync(dataId: DataId): BackendValues {\n    // Route the read to the\n  correct backend.\n    const info = this.state.tensorInfo.get(dataId);\n    return info.backend.readSync(dataId);\n  }\n  read(dataId: DataId): Promise<BackendValues> {\n    // Route the read to the correct backend.\n    const info =\n  this.state.tensorInfo.get(dataId);\n    return info.backend.read(dataId);\n  }\n  async time(query: () => void):\n  Promise<TimingInfo> {\n    const start = now();\n    const timingInfo = await this.backend.time(query) as\n  TimingInfo;\n    timingInfo.wallMs = now() - start;\n    return timingInfo;\n  }\n  /**\n   * Tracks a Tensor in the current scope to be automatically cleaned up\n   * when the current scope ends, and returns the value.\n   * @param result The Tensor to track in the current\n  scope.\n   */\n  private track<T extends Tensor>(result: T): T {\n    if (this.state.activeScope != null) {\n      result.scopeId = this.state.activeScope.id;\n      this.state.activeScope.track.push(result);\n    }\n    return result;\n  }\n  get registeredVariables(): NamedVariableMap {\n    return this.state.registeredVariables;\n  }\n  /**\n   * Resets the engine state. Removes all backends but does not remove\n   * registered backend factories.\n   */\n  reset(): void {\n    // Make any pending promise obsolete.\n    this.pendingBackendInitId++;\n    this.state.dispose();\n    this.ENV.reset();\n    this.state = new EngineState();\n    for (const backendName in\n  this.registry) {\n      this.disposeRegisteredKernels(backendName);\n      this.registry[backendName].dispose();\n    }\n  }\n}

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delete this.registry[backendName];\n }\n this.backendName = null;\n this.backendInstance = null;\n this.pendingBackendInit = null;\n }\n}\n\nfunction ones(shape: number[]): Tensor {\n  const values =\n    makeOnesTypedArray(sizeFromShape(shape), 'float32');\n  return ENGINE.makeTensor(values, shape,\n    'float32');\n}\n\n\nexport function getOrMakeEngine(): Engine {\n  const ns = getGlobalNamespace() as {} as\n    { _tfengine: Engine };\n  if (ns._tfengine == null) {\n    const environment = new Environment(ns);\n    ns._tfengine =\n      new Engine(environment);\n  }\n  setEnvironmentGlobal(ns._tfengine.ENV);\n  // Tell the current tensor interface\n  that the global engine is responsible\n  // for tracking.\n  setTensorTracker(() => ns._tfengine);\n  return\n    ns._tfengine;\n}\n\n\nexport const ENGINE = getOrMakeEngine();\n\n\n/**\n * A implementation of the add op for use\n  within engine and tape.\n * This allows us to avoid a circular dependency between add.ts and\n  engine.\n * It is exported to be available in tape tests.\n */\n\nexport function add(a: Tensor, b: Tensor): Tensor {\n  // We duplicate Add here to avoid a circular dependency with add.ts.\n  const inputs = {a, b};\n  return\n    ENGINE.runKernel(Add, inputs as {} as NamedTensorMap);\n}\n\n\n",/**\n * @license\n * Copyright 2017 Google\n  LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n  use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *\n  =====\n\n  */\n\n// tslint:disable-next-line:no-any\nfunction _isNavigatorDefined(): boolean {\n  return typeof navigator !==\n    'undefined' && navigator != null;\n}\n\n\nexport function isMobile(): boolean {\n  if (_isNavigatorDefined()) {\n    // tslint:disable-next-line:no-any\n    const a = navigator.userAgent || navigator.vendor || (window as any).opera;\n    // tslint:disable-next-line:max-line-length\n    return\n      /(android|bb\\d+|meego).+mobile|avantgo|bada\\/|blackberry|blazer|compal|elaine|fennec|hiptop|iemoible|ip(hone|od)|\n        iris|kindle|lge |maemo|midp|mmp|mobile.+firefox|netfront|opera m(ob|in)i|palm(\n        os)?|phone|p(ixi|re)|\\/|plucker|pocket|psp|series(4|6|0)|symbian|treo|up\\.\\. (browser|link)|vodafone|wap|windows\n        ce|xda|xiino|i\n        .test(a) ||\n        // tslint:disable-next-line:max-line-length\n        /1207|6310|6590|3gso|4thp|50[1-6]|i770s|802s|a w|abac|ac(er|oo|s|\\-\n        )|ai(ko|rn)|al(av|ca|co)|amoi|an(ex|ny|yw)|aptu|ar(ch|go)|as(te|us)|attw|au(di|\\-|m|r |s\n        )|avan|be|ck|ll|nq|bi(b|rd|bl|ac|az)|br(e|v)w|bumb|bw|\\-(n|u)|c55|\\/|capi|ccwa|cdm|\\-|cell|chtm|clde|cmd|\\-\n        |co(mp|nd)|craw|da(it|ll|ng)|dbte|dc|\\-|s|devi|dica|dmob|do(c|p)|ds(12|\\-|d)|el(49|ai)|em(12|ul)|er(ic|k0)|esl8|ez([4-\n        7]|0|os|swa|ze)|fetc|fly(\\-|_)|g1\n        u|g560|gene|gf|\\-|5|g|\\-|mo|go(\\.\\.w|od)|gr(ad|un)|haie|hcit|hd|\\-(m|p|t)|hei|\\-|hi(pt|ta)|hp( i|ip)|hs|\\-|c|ht(c|\\-|\n        |_|a|g|p|s|t)|tp)|hu(aw|tc)|i|\\-(20|go|ma)|i230|iac( |\\-\n        |\\/|\\|bro|idea|ig01|ikom|im1k|inno|ipaq|iris|ja(t|v)|aj|bro|jemu|jigs|kddi|keji|kgt( |\\/|)klon|kpt |kwc|\\-\n        |kyo(c|k)|le(no|xi)|lg( g|\\|(k|l|u)|50|54|\\-|a-w)|libw|lynx|m1|\\-|w|m3ga|m50|\\/|ma(te|ui|xo)|mc(01|21|ca)|m|\\-\n        cr|me(rc|ri)|mi(o8|oa|ts)|mmef|mo(01|02|bi|de|do|t(\\-| |o|v)|zz)|mt(50|p1|v )|mwbp|mywa|n10[0-2]|n20[2-\n        3]|n30[0-2]|n50[0-2]|5|n7(0|01)|10)|ne((c|m)|\\-\n        |on|t|fw|wg|wt)|nok(6|i)|nzph|o2im|op(ti|wv)|oran|owg1|p800|pan(a|d|t)|pdxg|pg(13|\\-|([1-\n        8]|c))|phil|pire|pl(ay|uc)|pn\\-|2|po(ck|rt|se)|prox|psio|pt|\\-|g|qa|\\-|a|qc(07|12|21|32|60|\\-|2-7)|i|\\-\n        )|qtek|r380|r600|raks|rim9|ro(ve|zo)|s55|\\/|sa(ge|ma|mm|ms|ny|va)|sc(01|h|\\-|oo|p|\\-)|sdk|\\/|se(c|\\-\n        |01|)47|mc|nd|ri)|sgh|\\-|shar|sie(\\-|m)|sk|\\-|0|sl(45|id)|sm(al|ar|b3|it|t5)|so(ft|ny)|sp(01|h|\\-|v|\\-|v\n        )|sy(01|mb)|t2(18|50)|t6(00|10|18)|ta(gt|lk)|tcl|\\-|tdg|\\-|tel(i|m)|tim|\\-|t|\\-|mo|to(pl|sh)|ts(70|m|\\-|m3|m5)|tx|\\-\n        9|up(\\-|b|g1|si)|utst|v400|v750|veri|vi(rg|te)|vk(40|5[0-3]|\\-\n        v)|vm40|voda|vulc|vx(52|53|60|61|70|80|81|83|85|98)|w3c(\\-| )|webc|whit|wi(g |nc|nw)|wmlb|wonu|x700|yas|\\-\n        |your|zeto|zte|\\-|i\n        .test(a.substr(0, 4));\n  }\n  return false;\n}\n\n\nexport function isBrowser(): boolean {\n  return (typeof window !== 'undefined' && window.document != null) ||\n    // @ts-ignore\n    (typeof\n      WorkerGlobalScope !== 'undefined');\n}\n\n\n",/**\n * @license\n * Copyright 2019 Google LLC. 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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\nimport './engine';\nimport * as device_util from './device_util';\nimport {env} from './environment';\nconst
ENV = env();\n\n/**\n * This file contains environment-related flag registrations.\n *\n ** Whether to enable
debug mode. *\nENV.registerFlag('DEBUG', () => false, debugValue => {\n if (debugValue) {\n
console.warn(\n   'Debugging mode is ON. The output of every math call will '+\n   'be downloaded to CPU
and checked for NaNs. '+\n   'This significantly impacts performance.);\n });\n\n ** Whether
we are in a browser (as versus, say, node.js) environment. *\nENV.registerFlag('IS_BROWSER', () =>
device_util.isBrowser());\n\n ** Whether we are in a browser (as versus, say, node.js) environment.
*\nENV.registerFlag(\n  'IS_NODE',\n  () => (typeof process !== 'undefined') &&\n    (typeof process.versions
!== 'undefined') &&\n    (typeof process.versions.node !== 'undefined'));\n\n ** Whether this browser is Chrome.
*\nENV.registerFlag(\n  'IS_CHROME',\n  () => typeof navigator !== 'undefined' && navigator != null &&\n    navigator.userAgent != null && /Chrome/.test(navigator.userAgent) &&\n    /Google
Inc/.test(navigator.vendor));\n\n **\n * True when the environment is \"production\" where we disable safety
checks\n * to gain performance.\n *\nENV.registerFlag('PROD', () => false);\n\n **\n * Whether to do sanity
checks when inferring a shape from user-provided\n * values, used when creating a new tensor.\n
*\nENV.registerFlag(\n  'TENSORLIKE_CHECK_SHAPE_CONSISTENCY',\n  () => ENV.getBool('DEBUG'));\n\n ** Whether deprecation warnings are enabled.
*\nENV.registerFlag('DEPRECATION_WARNINGS_ENABLED', () => true);\n\n ** True if running unit tests.
*\nENV.registerFlag('IS_TEST', () => false);\n\n ** Whether to check computation result for errors.
*\nENV.registerFlag('CHECK_COMPUTATION_FOR_ERRORS', () => true);\n\n **\n * @license\n * Copyright
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====
*\n\nimport {ENGINE} from './engine';\nimport {env} from './environment';\nimport {Tensor} from
 './tensor';\nimport {DataType, TensorLike} from './types';\nimport {assert, flatten, inferDtype, isTypedArray,
toTypedArray} from './util';\n\nexport function inferShape(val: TensorLike, dtype?: DataType): number[] {\n let
firstElem: typeof val = val;\n if (isTypedArray(val)) {\n return dtype === 'string' ? [] : [val.length];\n }\n if
(!Array.isArray(val)) {\n return []; // Scalar.\n }\n const shape: number[] = [];\n\n while
(Array.isArray(firstElem) ||\n   isTypedArray(firstElem) && dtype !== 'string') {\n
shape.push(firstElem.length);\n firstElem = firstElem[0];\n }\n if (Array.isArray(val) &&\n
env().getBool('TENSORLIKE_CHECK_SHAPE_CONSISTENCY')) {\n deepAssertShapeConsistency(val,
shape, []);\n }\n\n return shape;\n}\n\nfunction deepAssertShapeConsistency(\n
  val: TensorLike, shape: number[], indices: number[]) {\n indices = indices || [];\n if (!(Array.isArray(val)) &&
!isTypedArray(val)) {\n assert(\n   shape.length === 0,\n   () => `Element arr[${indices.join(',')}] is a
primitive, ` +\n   `but should be an array/TypedArray of ${shape[0]} elements`);\n return;\n }\n assert(\n
  shape.length > 0,\n   () => `Element arr[${indices.join(',')}] should be a primitive, ` +\n   `but is an array of
${val.length} elements`);\n assert(\n   val.length === shape[0],\n   () => `Element arr[${indices.join(',')}]

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should have ${shape[0]} `+` elements, but has ${val.length} elements`);
const subShape =
shape.slice(1);
for (let i = 0; i < val.length; ++i) {
  deepAssertShapeConsistency(val[i], subShape,
indices.concat(i));
}
function assertDtype(
  expectedDtype: DataType|'numeric'|'string_or_numeric',
actualDType: DataType, argName: string, functionName: string)
{
  if (expectedDtype === 'string_or_numeric') {
    return;
  }
  if (expectedDtype === null) {
    throw new
Error(`Expected dtype cannot be null.`);
  }
  if (expectedDtype !== 'numeric' && expectedDtype !==
actualDType ||
  expectedDtype === 'numeric' && actualDType === 'string') {
    throw new Error(`
Argument '${argName}' passed to '${functionName}' must `+
`be ${expectedDtype} tensor, but got
${actualDType} tensor`);
  }
}
export function convertToTensor<T extends Tensor>(
  x: T|TensorLike,
argName: string, functionName: string,
  parseAsDtype: DataType|'numeric'|'string_or_numeric' = 'numeric'): T
{
  if (x instanceof Tensor) {
    assertDtype(parseAsDtype, x.dtype, argName, functionName);
    return x;
  }
  let inferredDtype = inferDtype(x);
  // If the user expects a bool/int/float, use that info to update the
  // inferredDtype when it is not a string.
  if (inferredDtype !== 'string' &&
    ['bool', 'int32',
'float32'].indexOf(parseAsDtype)
>= 0) {
    inferredDtype = parseAsDtype as DataType;
  }
  assertDtype(parseAsDtype, inferredDtype,
argName, functionName);
  if ((x === null) ||
    (!isTypedArray(x) && !Array.isArray(x) && typeof x !==
'number' &&
    typeof x !== 'boolean' && typeof x !== 'string')) {
    const type = x === null ? 'null' : (x as
{}).constructor.name;
    throw new Error(`
Argument '${argName}' passed to '${functionName}' must be a
`+
`Tensor or TensorLike, but got '${type}'`);
  }
  const inferredShape = inferShape(x, inferredDtype);
  if (!isTypedArray(x) && !Array.isArray(x)) {
    x = [x] as number[];
  }
  const skipTypedArray = true;
  const
values = inferredDtype !== 'string' ?
toTypedArray(x, inferredDtype as DataType) :
flatten(x as string[],
[], skipTypedArray) as string[];
return ENGINE.makeTensor(values, inferredShape, inferredDtype) as
T;
}
export function convertToTensorArray<T extends Tensor>(
  arg:
Array<T|TensorLike>, argName: string, functionName: string,
  parseAsDtype:
DataType|'numeric'|'string_or_numeric' = 'numeric'): T[]
{
  if (!Array.isArray(arg)) {
    throw new Error(`
Argument ${argName} passed to ${functionName} must be a
`+
`Tensor[] or TensorLike[]`);
  }
  const tensors = arg as T[];
  return tensors.map(
    (t, i) =>
convertToTensor(t, `${argName}[${i}]`,
functionName, parseAsDtype);
  );
}
}
/**
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 * software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
 * OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
import {ENGINE} from '../engine';
import {isPromise} from '../util';
export const OP_SCOPE_SUFFIX =
'__op';
/**
 * Used for wrapping functions that perform math operations on
 * Tensors. The function will be
 * wrapped in a named scope that cleans all
 * memory usage after the function is done.
 */
export function op<T
extends Function>(f: {[name: string]: T}): T
{
  const keys = Object.keys(f);
  if (keys.length !== 1) {
    throw
new Error(`
Please provide an object with a single key `+
` (operation name) mapping to a function. Got
an object with `+
`${keys.length} keys.`);
  }
  let opName = keys[0];
  const fn = f[opName];
  // Strip the underscore from the end of the function name.
  if (opName.endsWith('_')) {
    opName =
opName.substring(0,
opName.length - 1);
  }
  // add an __op suffix to distinguish ops from kernels in tf.profile
  opName =
opName + OP_SCOPE_SUFFIX;
  // tslint:disable-next-line:no-any
  const f2 = (...args: any[]) => {
    ENGINE.startScope(opName);
    try {
      const result = fn(...args);
      if (isPromise(result)) {
        console.error('Cannot return a Promise inside of tidy.');
```

```

opName, configurable: true});\n\n // tslint:disable-next-line:no-any\n return f2 as any as T;\n}\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {ENGINE} from './engine';\nimport {Complex, ComplexInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from
'./operation';\n/**\n * Converts two real numbers to a complex number.\n *\n * Given a tensor `real` representing
the real part of a complex number, and a\n * tensor `imag` representing the imaginary part of a complex number,
this\n * operation returns complex numbers elementwise
of the form [r0, i0, r1, i1],\n * where r represents the real part and i represents the imag part.\n *\n * The input
tensors real and imag must have the same shape.\n *\n * ``js\n * const real = tf.tensor1d([2.25, 3.25]);\n * const
imag = tf.tensor1d([4.75, 5.75]);\n * const complex = tf.complex(real, imag);\n * const complex.print();\n * ``\n *\n *
@doc {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction complex_<T extends Tensor>(real: T|TensorLike,
imag: T|TensorLike): T {\n  const $real = convertToTensor(real, 'real', 'complex');\n  const $imag =
convertToTensor(imag, 'imag', 'complex');\n  util.assertShapesMatch(\n    $real.shape, $imag.shape,\n    `real and
imag shapes, ${$real.shape} and ${$imag.shape}, ` +\n    `must match in call to tf.complex().`);\n\n  const
inputs: ComplexInputs = {real: $real, imag: $imag};\n  return ENGINE.runKernel(Complex, inputs as {}) as
NamedTensorMap);\n}\n\nexport const complex = op({complex_});\n"/**\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {TensorLike, TypedArray}
from './types';\nimport {DataType} from './types';\nimport {assert, assertNonNegativeIntegerDimensions, flatten,
inferDtype, isTypedArray, sizeFromShape, toTypedArray} from './util';\n/** This is
shared code across all tensor creation methods. *\nexport function makeTensor(\n  values: TensorLike, shape:
number[], inferredShape: number[],\n  dtype?: DataType): Tensor {\n  if (dtype == null) {\n    dtype =
inferDtype(values);\n  }\n  if (dtype === 'complex64') {\n    throw new Error(\n      `Cannot construct a complex64
tensor directly. ` +\n      `Please use tf.complex(real, imag).`);\n  }\n  if (!isTypedArray(values) &&
!Array.isArray(values) &&\n    typeof values !== 'number' && typeof values !== 'boolean' &&\n    typeof values
!== 'string') {\n    throw new Error(\n      `values passed to tensor(values) must be a number/boolean/string or ` +\n
      `an array of numbers/booleans/strings, or a TypedArray`);\n  }\n  if (shape != null) {\n
assertNonNegativeIntegerDimensions(shape);\n\n    const providedSize = sizeFromShape(shape);\n    const
inferredSize = sizeFromShape(inferredShape);\n    assert(\n      providedSize === inferredSize,\n      () =>\n
      `Based on the provided shape, [${shape}], the tensor should have ` +\n      `${providedSize} values but has
${inferredSize}`);\n\n    for (let i = 0; i < inferredShape.length; ++i) {\n      const inferred = inferredShape[i];\n
const flatDimsDontMatch = i === inferredShape.length - 1 ?\n      inferred !== sizeFromShape(shape.slice(i)) :\n
      true;\n      assert(\n        inferredShape[i] === shape[i] || !flatDimsDontMatch,\n        () => `Error creating
a
new Tensor. Inferred shape ` +\n        `${inferredShape}` does not match the provided ` +\n        `shape
[${shape}].`);\n    }\n  }\n  if (!isTypedArray(values) && !Array.isArray(values)) {\n    values = [values] as

```



```

number[];
}

shape = shape || inferredShape;
values = dtype !== 'string' ?
toTypedArray(values, dtype) :
flatten(values as string[], [], true) as string[];
return ENGINE.makeTensor(values as TypedArray, shape,
dtype);
"/**
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/

import { Tensor } from './tensor';
import { inferShape } from './tensor_util_env';
import { TensorLike } from './types';
import { DataType, Rank, ShapeMap } from './types';
import { makeTensor } from './tensor_ops_util';

/**
 * Creates a `tf.Tensor` with the provided values, shape and dtype.
 *
 * ```js
 * // Pass an array of values to create a vector.
 * tf.tensor([1, 2, 3, 4]).print();
 *
 * // Pass a nested array of values to make a matrix or a higher
 * // dimensional tensor.
 * tf.tensor([[1, 2], [3, 4]]).print();
 *
 * // Pass a flat array and specify a shape yourself.
 * tf.tensor([1, 2, 3, 4], [2, 2]).print();
 *
 * @param values The values of the tensor. Can be nested array of numbers,
 * or a flat array, or a `TypedArray`. If the values are strings, they will be encoded as utf-8 and kept as `Uint8Array`.
 * @param shape The shape of the tensor. Optional. If not provided, it is inferred from `values`.
 * @param dtype The data type.
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
export function tensor<R extends Rank>(
  values: TensorLike, shape?: ShapeMap[R], dtype?: DataType): Tensor<R> {
  const inferredShape = inferShape(values, dtype);
  return makeTensor(values, shape, inferredShape, dtype) as Tensor<R>;
}

"/**
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/

/**
 * Type definitions for exporting and importing of models.
 */

/**
 * A map from Tensor dtype to number of bytes per element of the Tensor.
 */
export const DTYPE_VALUE_SIZE_MAP: {[dtype: string]: number} = {
  'float32': 4,
  'float16': 2,
  'int32': 4,
  'uint16': 2,
  'uint8': 1,
  'bool': 1,
  'complex64': 8
};

/**
 * A weight manifest.
 *
 * The weight manifest consists of an ordered list of weight-manifest groups.
 * Each weight-manifest group ("group" for short hereafter) consists of a
 * number of weight values stored in a number of paths.
 * See the documentation of `WeightManifestGroupConfig` below for more details.
 */
export declare type WeightsManifestConfig = WeightsManifestGroupConfig[];

/**
 * A weight-manifest group.
 *
 * Consists of an ordered list of weight values encoded in binary format,
 * stored in an ordered list of paths.
 */
export declare interface WeightsManifestGroupConfig {
  /**
   * An ordered list of paths.
   *
   * Paths are intentionally abstract in order to be general. For example, they
   * can be relative URL paths or relative paths on the file system.
   */
  paths: string[];

  /**
   * Specifications of the weights stored in the paths.
   */
  weights: WeightsManifestEntry[];
}

/**
 * Group to which the weight belongs.
 */
- 'optimizer': Weight from a stateful optimizer.
export type WeightGroup = 'model'|'optimizer';

/**
 * An entry in the weight manifest.
 *
 * The entry contains specification of a weight.
 */
export declare interface WeightsManifestEntry {
  /**
   * Name of the weight, e.g., 'Dense_1/bias'
   */
  name: string;

  /**
   * Shape of the weight.
   */
  shape: number[];

  /**
   * Data type of the weight.
   */
  dtype: 'float32'|'int32'|'bool'|'string'|'complex64';

  /**
   * Type of the weight.
   */
  /**
   * Optional.
   */
  /**
   * The value

```

'optimizer' indicates the weight belongs to an optimizer (i.e., used only during model training and not during inference).

`group?: WeightGroup;` Information for dequantization of the weight.

`quantization?: { scale?: number, // The scaling constant to multiply by. min?: number, // The (possibly nudged) minimum weight to add. dtype: 'uint16'|'uint8'|'float16' // The dtype of the quantized weights. };` Options for saving a model.

`@innamespace io`

`export interface SaveConfig { trainableOnly?: boolean; // Whether to save only the trainable weights of the model, ignoring the non-trainable ones. includeOptimizer?: boolean; // Whether the optimizer will be saved (if exists). Default: `false`. result?: boolean; // Result of a saving operation. }`

`export interface SaveResult { modelArtifactsInfo: ModelArtifactsInfo; // HTTP responses from the server that handled the model-saving request (if any). This is applicable only to server-based saving routes. responses?: Response[]; // Error messages and related data (if any). errors?: Array<{}|string>; }`

`export declare interface ModelArtifactsInfo { dateSaved: Date; // TODO(cais,yassogba) consider removing GraphDef as GraphDefs now. // come in a JSON format and none of our IOHandlers support a non json format. We could consider replacing this with 'Binary' if we want to allow future handlers to save to non json formats (though they will probably want more information than 'Binary'). topologyType: 'JSON'|'GraphDef'; // Type of the model topology. Possible values: - JSON: JSON config (human-readable, e.g., Keras JSON). - GraphDef: TensorFlow [GraphDef](https://www.tensorflow.org/extend/tool_developers/#graphdef) protocol buffer (binary). size: number; // Size of model topology (Keras JSON or GraphDef), in bytes. topologyBytes?: number; // Size of weight specification or manifest, in bytes. weightSpecsBytes?: number; // Size of weight value data, in bytes. weightDataBytes?: number; }`

`export declare interface TrainingConfig { // TODO(cais): Tighten the typing once keras spec is available to tfjs-core. // See // tslint:disable-next-line:max-line-length // https://github.com/tensorflow/tfjs-layers/blob/master/src/keras_format/training_config.ts optimizer: string; // Optimizer used for the model training. optimizer_config: {}; // TODO(cais): Tighten the typing once keras spec is available to tfjs-core. // ** Loss function(s) for the model's output(s). loss: string|string[]|{[key: string]: string}; // TODO(cais): Tighten the typing once keras spec is available to tfjs-core. // ** Metric function(s) for the model's output(s). metrics?: string[]|{[key: string]: string}; // TODO(cais): Tighten the typing once keras spec is available to tfjs-core. // weighted_metrics?: string[]; // TODO(cais): Tighten the typing once keras spec is available to tfjs-core. // sample_weight_mode?: string; loss_weights?: number[]|{[key: string]: number}; }`

`ModelArtifacts` The serialized artifacts of a model, including topology and weights. The `modelTopology`, `trainingConfig`, `weightSpecs` and `weightData` fields of this interface are optional, in order to support topology- or weights-only saving and loading. Note this interface is used internally in IOHandlers. For the file format written to disk as `model.json`, see `ModelJSON`.

`export declare interface ModelArtifacts { modelTopology?: {}|ArrayBuffer; // Serialized configuration for the model's training. trainingConfig?: TrainingConfig; // Weight specifications. This corresponds to the weightsData below. weightSpecs?: WeightsManifestEntry[]; // Binary buffer for all weight values concatenated in the order specified by `weightSpecs`. weightData?: ArrayBuffer; // Hard-coded format name for models saved from TensorFlow.js or converted by TensorFlow.js Converter. format?: string; // What library is responsible for originally generating this artifact. Used for debugging purposes. E.g., 'TensorFlow.js v1.0.0'. generatedBy?: string; // What library or tool is responsible for converting the original model to this format, applicable only if the model is output by a converter. Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'. conversion?: string; // A value of `null` means the model artifacts are generated without any conversion. }`

process (e.g., saved directly from a TensorFlow.js `tf.LayersModel`` instance.)
`string|null;`
`/**` `Inputs and outputs signature for saved model.`
`signature?: {};`
`/**` `User-defined metadata about the model.`
`userDefinedMetadata?: {[key: string]: {}};`
`/**` `Initializer for the model.`
`modelInitializer?: {};`
`/**` `The on-disk format of the `model.json` file.`
`TF.js 1.0` always populates the optional fields when writing `model.json`.
Prior versions did not provide those fields.
`/**` `export declare interface ModelJSON {`
`/**` `Model topology.`
`/**` `For Keras-style `tf.Model`s, this is a JSON object.`
`/**` `For TensorFlow-style models (e.g., `SavedModel`), this is the JSON`
`encoding of the `GraphDef` protocol buffer.`
`modelTopology: {};`
`/**` `Model training configuration.`
`trainingConfig?: TrainingConfig;`
`/**` `Weights manifest.`
`/**` `The weights manifest consists of an ordered list of weight-manifest`
`groups. Each weight-manifest group consists of a number of weight values`
`stored in a number of paths. See the documentation of`
`WeightsManifestConfig` for more details.`
`weightsManifest: WeightsManifestConfig;`
`/**` `Hard-coded format name for models saved from TensorFlow.js or converted`
`by TensorFlow.js Converter.`
`format?: string;`
`/**` `What library is responsible for originally generating this artifact.`
`/**` `Used for debugging purposes. E.g., `TensorFlow.js v1.0.0`.`
`generatedBy?: string;`
`/**` `What library or tool is responsible for converting the original model`
`to this format, applicable only if the model is output by a converter.`
`/**` `Used for debugging purposes. E.g., `TensorFlow.js Converter v1.0.0`.`
`/**` `A value of `null` means the model artifacts are generated without any`
`conversion process (e.g., saved directly from a TensorFlow.js`
`tf.LayersModel` instance.)`
`convertedBy?: string|null;`
`/**` `Inputs and outputs signature for saved model.`
`signature?: {};`
`/**` `User-defined metadata about the model.`
`userDefinedMetadata?: {[key: string]: {}};`
`/**` `Initializer for the model.`
`modelInitializer?: {};`
`/**` `Type definition for handlers of loading operations.`
`/**` `export type LoadHandler = () => Promise<ModelArtifacts>;`
`/**` `Type definition for handlers of saving operations.`
`/**` `export type SaveHandler = (modelArtifact: ModelArtifacts) => Promise<SaveResult>;`
`/**` `Interface for a model import/export handler.`
`/**` `The `save` and `load` handlers are both optional, in order to allow handlers`
`that support only saving or loading.`
`tslint:disable-next-line:interface-name`
`/**` `export interface IOHandler {`
`save?: SaveHandler;`
`load?: LoadHandler;`
`/**` `An interface for the manager of a model store.`
`/**` `A model store is defined as a storage medium on which multiple models can`
`be stored. Each stored model has a unique `path` as its identifier.`
`/**` `A `ModelStoreManager` for the store allows actions including`
`- Listing the models stored in the store.`
`- Deleting a model from the store.`
`/**` `export interface ModelStoreManager {`
`/**` `List all models in the model store.`
`/**` `@returns A dictionary mapping paths of existing models to their`
`model artifacts info. Model artifacts info include type of the model's`
`topology, byte sizes of the topology, weights, etc.`
`listModels(): Promise<{[path: string]: ModelArtifactsInfo}>;`
`/**` `Remove a model specified by `path`.`
`/**` `@param path`
`/**` `@returns ModelArtifactsInfo of the deleted model (if and only if deletion`
`is successful).`
`/**` `@throws Error if deletion fails, e.g., if no model exists at `path`.`
`removeModel(path: string): Promise<ModelArtifactsInfo>;`
`/**` `Callback for the progress of a long-running action such as an HTTP`
`request for a large binary object.`
`/**` `fraction` should be a number in the [0, 1] interval, indicating how`
`much of the action has completed.`
`/**` `export type OnProgressCallback = (fraction: number) => void;`
`/**` `@namespace io`
`/**` `export interface LoadOptions {`
`/**` `RequestInit (options) for HTTP requests.`
`/**` `For detailed information on the supported fields, see`
`[https://developer.mozilla.org/en-US/docs/Web/API/Request/Request]`
`(`
`https://developer.mozilla.org/en-US/docs/Web/API/Request/Request)`
`requestInit?: RequestInit;`
`/**` `Progress callback.`
`/**` `onProgress?: OnProgressCallback;`
`/**` `A function used to override the `window.fetch` function.`
`/**` `fetchFunc?: Function;`
`/**` `Strict loading model: whether extraneous weights or missing`
`weights should trigger an `Error`.`
`/**` `If `true`, require that the provided weights exactly match those`
`required by the layers. `false` means that both extra weights`
`and missing weights will be silently ignored.`
`/**` `Default: `true`.`
`/**` `strict?:`

```

boolean;\n\n /**\n * Path prefix for weight files, by default this is calculated from the\n * path of the model
JSON file.\n *\n * For instance, if the path to the model JSON file is\n * `http://localhost/foo/model.json`, then
the default path prefix will be\n * `http://localhost/foo/`. If a weight file has the path value\n * `group1-shard1of2`
in the weight manifest, then the weight file will be\n * loaded from `http://localhost/foo/group1-shard1of2` by
default. However,\n * if you provide a `weightPathPrefix` value of\n * `http://localhost/foo/alt-weights`, then the
weight file will be loaded\n * from the path `http://localhost/foo/alt-weights/group1-shard1of2` instead.\n */\n
weightPathPrefix?: string;\n\n /**\n * Whether the
module or model is to be loaded from TF Hub.\n *\n * Setting this to `true` allows passing a TF-Hub module
URL, omitting the\n * standard model file name and the query parameters.\n *\n * Default: `false`.\n */\n
fromTFHub?: boolean;\n\n /**\n * An async function to convert weight file name to URL. The weight file\n *
names are stored in model.json's weightsManifest.paths field. By default we\n * consider weight files are colocated
with the model.json file. For example:\n * model.json URL: https://www.google.com/models/1/model.json\n *
group1-shard1of1.bin url:\n * https://www.google.com/models/1/group1-shard1of1.bin\n *\n * With this
func you can convert the weight file name to any URL.\n */\n
weightUrlConverter?: (weightFileName: string) =>
Promise<string>;\n\n\n/**\n * Additional options for Platform.fetch\n */\nexport interface RequestDetails {\n
/**\n * Is this request for a binary file (as opposed to a json file)\n */\n isBinary?:
boolean;\n}\n\n","use strict\n\nexports.byteLength = byteLength\nexports.toByteArray =
toByteArray\nexports.fromByteArray = fromByteArray\n\nvar lookup = []\nvar revLookup = []\nvar Arr = typeof
Uint8Array !== 'undefined' ? Uint8Array : Array\n\nvar code =
'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/'\nfor (var i = 0, len =
code.length; i < len; ++i) {\n lookup[i] = code[i]\n revLookup[code.charCodeAt(i)] = i\n}\n\n// Support decoding
URL-safe base64 strings, as Node.js does.\n// See:
https://en.wikipedia.org/wiki/Base64#URL_applications\nrevLookup['-'.charCodeAt(0)] =
62\nrevLookup['_'.charCodeAt(0)] = 63\n\nfunction getLens (b64) {\n var len = b64.length\n\n if (len % 4 > 0) {\n
throw new Error('Invalid string. Length must be a multiple of 4')\n }\n\n // Trim off extra bytes after placeholder
bytes are found\n // See: https://github.com/beatgammit/base64-js/issues/42\n var validLen = b64.indexOf('=')\n if
(validLen === -1) validLen = len\n\n var
placeholdersLen = validLen === len\n ? 0\n : 4 - (validLen % 4)\n\n return [validLen,
placeholdersLen]\n}\n\n// base64 is 4/3 + up to two characters of the original data\nfunction byteLength (b64) {\n
var lens = getLens(b64)\n var validLen = lens[0]\n var placeholdersLen = lens[1]\n return ((validLen +
placeholdersLen) * 3 / 4) - placeholdersLen\n}\n\nfunction _byteLength (b64, validLen, placeholdersLen) {\n
return ((validLen + placeholdersLen) * 3 / 4) - placeholdersLen\n}\n\nfunction toByteArray (b64) {\n var tmp\n
var lens = getLens(b64)\n var validLen = lens[0]\n var placeholdersLen = lens[1]\n var arr = new
Arr(_byteLength(b64, validLen, placeholdersLen))\n\n var curByte = 0\n\n // if there are placeholders, only get up
to the last complete 4 chars\n var len = placeholdersLen > 0\n ? validLen - 4\n : validLen\n\n var i\n for (i = 0;
i < len; i += 4) {\n tmp =\n (revLookup[b64.charCodeAt(i)] << 18) |\n (revLookup[b64.charCodeAt(i + 1)]
<< 12) |\n (revLookup[b64.charCodeAt(i + 2)] << 6) |\n revLookup[b64.charCodeAt(i + 3)]\n
arr[curByte++] = (tmp >> 16) & 0xFF\n arr[curByte++] = (tmp >> 8) & 0xFF\n arr[curByte++] = tmp & 0xFF\n
}\n\n if (placeholdersLen === 2) {\n tmp =\n (revLookup[b64.charCodeAt(i)] << 2) |\n
(revLookup[b64.charCodeAt(i + 1)] >> 4)\n arr[curByte++] = tmp & 0xFF\n }\n\n if (placeholdersLen === 1)
{\n tmp =\n (revLookup[b64.charCodeAt(i)] << 10) |\n (revLookup[b64.charCodeAt(i + 1)] << 4) |\n
(revLookup[b64.charCodeAt(i + 2)] >> 2)\n arr[curByte++] = (tmp >> 8) & 0xFF\n arr[curByte++] = tmp &
0xFF\n }\n\n return arr\n}\n\nfunction tripletToBase64 (num) {\n return lookup[num >> 18 & 0x3F] +\n
lookup[num >> 12 & 0x3F] +\n lookup[num >> 6 & 0x3F] +\n lookup[num & 0x3F]\n}\n\nfunction
encodeChunk (uint8, start, end) {\n var tmp\n var output = []\n for (var i = start; i < end; i += 3) {\n tmp =\n
((uint8[i] << 16) & 0xFF0000)
+\n ((uint8[i + 1] << 8) & 0xFF00) +\n (uint8[i + 2] & 0xFF)\n output.push(tripletToBase64(tmp))\n }\n
return output.join('')\n}\n\nfunction fromByteArray (uint8) {\n var tmp\n var len = uint8.length\n var extraBytes =

```

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len % 3 // if we have 1 byte left, pad 2 bytes
var parts = []
var maxChunkLength = 16383 // must be multiple of
3
// go through the array every three bytes, we'll deal with trailing stuff later
for (var i = 0, len2 = len -
extraBytes; i < len2; i += maxChunkLength) {
  parts.push(encodeChunk(uint8, i, (i + maxChunkLength) >
len2 ? len2 : (i + maxChunkLength)))
}
// pad the end with zeros, but make sure to not forget the extra
bytes
if (extraBytes === 1) {
  tmp = uint8[len - 1]
  parts.push(lookup[tmp >> 2] + lookup[(tmp
<< 4) & 0x3F] + ' ')
} else if (extraBytes === 2) {
  tmp = (uint8[len - 2] << 8) + uint8[len - 1]
  parts.push(lookup[tmp >> 10] +
lookup[(tmp >> 4) & 0x3F] + lookup[(tmp << 2) & 0x3F] + ' ')
return
parts.join('')
}, exports.read = function (buffer, offset, isLE, mLen, nBytes) {
  var e, m
  var eLen = (nBytes
* 8) - mLen - 1
  var eMax = (1 << eLen) - 1
  var eBias = eMax >> 1
  var nBits = -7
  var i = isLE ? (nBytes -
1) : 0
  var d = isLE ? -1 : 1
  var s = buffer[offset + i]
  i += d
  e = s & ((1 << (-nBits)) - 1)
  s >>= (-
nBits)
  nBits += eLen
  for (; nBits > 0; e = (e * 256) + buffer[offset + i], i += d, nBits -= 8) {}
  m = e & ((1
<< (-nBits)) - 1)
  e >>= (-nBits)
  nBits += mLen
  for (; nBits > 0; m = (m * 256) + buffer[offset + i], i += d,
nBits -= 8) {}
  if (e === 0) {
    e = 1 - eBias
  } else if (e === eMax) {
    return m ? NaN : ((s ? -1 : 1) *
Infinity)
  } else {
    m = m + Math.pow(2, mLen)
    e = e - eBias
  }
  return (s ? -1 : 1) * m * Math.pow(2, e
- mLen)
}
exports.write = function (buffer, value, offset, isLE,
mLen, nBytes) {
  var e, m, c
  var eLen = (nBytes * 8) - mLen - 1
  var eMax = (1 << eLen) - 1
  var eBias =
eMax >> 1
  var rt = (mLen === 23 ? Math.pow(2, -24) - Math.pow(2, -77) : 0)
  var i = isLE ? 0 : (nBytes - 1)
  var d = isLE ? 1 : -1
  var s = value < 0 || (value === 0 && 1 / value < 0) ? 1 : 0
  value = Math.abs(value)
  if (isNaN(value) || value === Infinity) {
    m = isNaN(value) ? 1 : 0
    e = eMax
  } else {
    e =
Math.floor(Math.log(value) / Math.LN2)
    if (value * (c = Math.pow(2, -e)) < 1) {
      e--
      c *= 2
    }
    if (e + eBias >= 1) {
      value += rt / c
    } else {
      value += rt * Math.pow(2, 1 - eBias)
    }
    if (value * c
>= 2) {
      e++
      c /= 2
    }
    if (e + eBias >= eMax) {
      m = 0
      e = eMax
    } else if (e + eBias
>= 1) {
      m = ((value * c) - 1) * Math.pow(2, mLen)
      e = e + eBias
    } else {
      m = value *
Math.pow(2, eBias - 1) * Math.pow(2, mLen)
      e
= 0
    }
  }
  for (; mLen >= 8; buffer[offset + i] = m & 0xff, i += d, m /= 256, mLen -= 8) {}
  e = (e <<
mLen) | m
  eLen += mLen
  for (; eLen > 0; buffer[offset + i] = e & 0xff, i += d, e /= 256, eLen -= 8) {}
  buffer[offset + i - d] |= s * 128
}
var toString = {}.toString;
module.exports = Array.isArray || function (arr) {
  return toString.call(arr) == '[object Array]';
};
/*!
 * The buffer module from node.js, for the browser.
 *
 * @author Feross Aboukhadijeh <feross@feross.org> <http://feross.org>
 * @license MIT
 *
 * use strict
 *
 * var base64 = require('base64-js')
 * var ieee754 = require('ieee754')
 * var isArray =
require('isArray')
exports.Buffer = Buffer
exports.SlowBuffer =
SlowBuffer
exports.inspect_max_bytes = 50
 * If `Buffer.TYPED_ARRAY_SUPPORT` is true
 * Use Uint8Array implementation (fastest)
 * false Use Object implementation (most compatible, even
IE6)
 * Browsers
that support typed arrays are IE 10+, Firefox 4+, Chrome 7+, Safari 5.1+, Opera 11.6+, iOS 4.2+.
 * Due to
various browser bugs, sometimes the Object implementation will be used even when the browser supports typed
arrays.
 * Note:
 * - Firefox 4-29 lacks support for adding new properties to `Uint8Array` instances.
 * See:
https://bugzilla.mozilla.org/show\_bug.cgi?id=695438.
 * - Chrome 9-10 is missing the
`TypedArray.prototype.subarray` function.
 * - IE10 has a broken `TypedArray.prototype.subarray` function
which returns arrays of incorrect length in some situations.
 * We detect these buggy browsers and set
`Buffer.TYPED_ARRAY_SUPPORT` to `false` so they get the Object implementation, which is slower but
behaves correctly.
 *
 * Buffer.TYPED_ARRAY_SUPPORT = global.TYPED_ARRAY_SUPPORT !==
undefined
 ? global.TYPED_ARRAY_SUPPORT
 : typedArraySupport()
 * Export kMaxLength after
typed array support is determined.
 *
 * exports.kMaxLength = kMaxLength()
function typedArraySupport () {
  try {
    var arr = new
Uint8Array(1)
    arr.__proto__ = {__proto__: Uint8Array.prototype, foo: function () { return 42 }}
    return
arr.foo() === 42 && // typed array instances can be augmented
    typeof arr.subarray === 'function' && //

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chrome 9-10 lack `subarray`\n      arr.subarray(1, 1).byteLength === 0 // ie10 has broken `subarray`\n } catch (e)
{\n  return false\n }\n}\n\nfunction kMaxLength () {\n  return Buffer.TYPED_ARRAY_SUPPORT\n ?
0x7fffffff\n : 0x3fffffff\n}\n\nfunction createBuffer (that, length) {\n  if (kMaxLength() < length) {\n    throw new
RangeError('Invalid typed array length')\n } \n  if (Buffer.TYPED_ARRAY_SUPPORT) {\n    // Return an
augmented `Uint8Array` instance, for best performance\n    that = new Uint8Array(length)\n    that.__proto__ =
Buffer.prototype\n } else {\n    // Fallback: Return an object instance of the Buffer class\n    if (that === null)
{\n      that = new Buffer(length)\n    }\n    that.length = length\n }\n\n  return that\n}\n\n/**\n * The Buffer
constructor returns instances of `Uint8Array` that have their\n * prototype changed to `Buffer.prototype`.
Furthermore, `Buffer` is a subclass of\n * `Uint8Array`, so the returned instances will have all the node `Buffer`
methods\n * and the `Uint8Array` methods. Square bracket notation works as expected -- it\n * returns a single
octet.\n * \n * The `Uint8Array` prototype remains unmodified.\n */\n\nfunction Buffer (arg, encodingOrOffset,
length) {\n  if (!Buffer.TYPED_ARRAY_SUPPORT && !(this instanceof Buffer)) {\n    return new Buffer(arg,
encodingOrOffset, length)\n }\n\n  // Common case.\n  if (typeof arg === 'number') {\n    if (typeof
encodingOrOffset === 'string') {\n      throw new Error(\n        'If encoding is specified then the first argument must
be a string'\n      )\n    }\n    return allocUnsafe(this, arg)\n }\n  return from(this, arg, encodingOrOffset,
length)\n}\n\nBuffer.poolSize
= 8192 // not used by this implementation\n\n// TODO: Legacy, not needed anymore. Remove in next major
version.\n\nBuffer._augment = function (arr) {\n  arr.__proto__ = Buffer.prototype\n  return arr\n}\n\nfunction from
(that, value, encodingOrOffset, length) {\n  if (typeof value === 'number') {\n    throw new TypeError('"value"\n
argument must not be a number')\n }\n\n  if (typeof ArrayBuffer !== 'undefined' && value instanceof ArrayBuffer)
{\n    return fromArrayBuffer(that, value, encodingOrOffset, length)\n }\n\n  if (typeof value === 'string') {\n
return fromString(that, value, encodingOrOffset)\n }\n\n  return fromObject(that, value)\n}\n\n/**\n * Functionally
equivalent to Buffer(arg, encoding) but throws a TypeError\n * if value is a number.\n * Buffer.from(str[,
encoding])\n * Buffer.from(array)\n * Buffer.from(buffer)\n * Buffer.from(arrayBuffer[, byteOffset[, length]])\n
**\n\nBuffer.from = function (value, encodingOrOffset, length) {\n  return
from(null, value, encodingOrOffset, length)\n}\n\nif (Buffer.TYPED_ARRAY_SUPPORT) {\n
Buffer.prototype.__proto__ = Uint8Array.prototype\n Buffer.__proto__ = Uint8Array\n if (typeof Symbol !==
'undefined' && Symbol.species &&\n   Buffer[Symbol.species] === Buffer) {\n   // Fix subarray() in ES2016.
See: https://github.com/feross/buffer/pull/97\n   Object.defineProperty(Buffer, Symbol.species, {\n     value: null,\n
configurable: true\n   })\n }\n}\n\nfunction assertSize (size) {\n  if (typeof size !== 'number') {\n    throw new
TypeError('"size"\n argument must be a number')\n } else if (size < 0) {\n    throw new RangeError('"size"\n
argument must not be negative')\n }\n}\n\nfunction alloc (that, size, fill, encoding) {\n  assertSize(size)\n  if (size
<= 0) {\n    return createBuffer(that, size)\n }\n  if (fill !== undefined) {\n    // Only pay attention to encoding if it's
a string. This\n    // prevents accidentally sending in a number that would\n    // be interpreted
as a start offset.\n    return typeof encoding === 'string'\n      ? createBuffer(that, size).fill(fill, encoding)\n      :
createBuffer(that, size).fill(fill)\n }\n  return createBuffer(that, size)\n}\n\n/**\n * Creates a new filled Buffer
instance.\n * alloc(size[, fill[, encoding]])\n **\n\nBuffer.alloc = function (size, fill, encoding) {\n  return alloc(null,
size, fill, encoding)\n}\n\nfunction allocUnsafe (that, size) {\n  assertSize(size)\n  that = createBuffer(that, size < 0 ?
0 : checked(size) | 0)\n  if (!Buffer.TYPED_ARRAY_SUPPORT) {\n    for (var i = 0; i < size; ++i) {\n      that[i] =
0\n    }\n  }\n  return that\n}\n\n/**\n * Equivalent to Buffer(num), by default creates a non-zero-filled Buffer
instance.\n * \n **\n\nBuffer.allocUnsafe = function (size) {\n  return allocUnsafe(null, size)\n}\n\n/**\n * Equivalent to
SlowBuffer(num), by default creates a non-zero-filled Buffer instance.\n * \n **\n\nBuffer.allocUnsafeSlow = function
(size) {\n  return allocUnsafe(null, size)\n}\n\nfunction
fromString (that, string, encoding) {\n  if (typeof encoding !== 'string' || encoding === '') {\n    encoding = 'utf8'\n
}\n\n  if (!Buffer.isEncoding(encoding)) {\n    throw new TypeError('"encoding"\n must be a valid string
encoding')\n }\n\n  var length = byteLength(string, encoding) | 0\n  that = createBuffer(that, length)\n\n  var actual =
that.write(string, encoding)\n  if (actual !== length) {\n    // Writing a hex string, for example, that contains invalid
characters will\n    // cause everything after the first invalid character to be ignored. (e.g.\n    // 'abxxcd' will be

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treated as 'ab')\n    that = that.slice(0, actual)\n  }\n\n  return that\n}\n\nfunction fromArrayLike (that, array) {\n  var\n  length = array.length < 0 ? 0 : checked(array.length) | 0\n  that = createBuffer(that, length)\n  for (var i = 0; i <\n  length; i += 1) {\n    that[i] = array[i] & 255\n  }\n  return that\n}\n\nfunction fromArrayBuffer (that, array,\n  byteOffset, length) {\n  array.byteLength\n  // this throws if `array` is not a valid ArrayBuffer\n\n  if (byteOffset < 0 || array.byteLength < byteOffset) {\n    throw new RangeError("'offset' is out of bounds")\n  }\n\n  if (array.byteLength < byteOffset + (length || 0)) {\n    throw new RangeError("'length' is out of bounds")\n  }\n\n  if (byteOffset === undefined && length ===\n  undefined) {\n    array = new Uint8Array(array)\n  } else if (length === undefined) {\n    array = new\n  Uint8Array(array, byteOffset)\n  } else {\n    array = new Uint8Array(array, byteOffset, length)\n  }\n\n  if\n  (Buffer.TYPED_ARRAY_SUPPORT) {\n    // Return an augmented `Uint8Array` instance, for best performance\n    that = array\n    that.__proto__ = Buffer.prototype\n  } else {\n    // Fallback: Return an object instance of the Buffer\n  class\n    that = fromArrayLike(that, array)\n  }\n  return that\n}\n\nfunction fromObject (that, obj) {\n  if\n  (Buffer.isBuffer(obj)) {\n    var len = checked(obj.length) | 0\n    that = createBuffer(that,\n    len)\n\n    if (that.length === 0) {\n      return that\n    }\n\n    obj.copy(that, 0, 0, len)\n    return that\n  }\n\n  if (obj)\n  {\n    if ((typeof ArrayBuffer !== 'undefined' &&\n    obj.buffer instanceof ArrayBuffer) || 'length' in obj) {\n      if\n      (typeof obj.length !== 'number' || isnan(obj.length)) {\n        return\n        createBuffer(that, 0)\n      }\n      return\n      fromArrayLike(that, obj)\n    }\n\n    if (obj.type === 'Buffer' && isArray(obj.data)) {\n      return\n      fromArrayLike(that, obj.data)\n    }\n  }\n\n  throw new TypeError('First argument must be a string, Buffer,\n  ArrayBuffer, Array, or array-like object.')

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false\n\n // No need
to verify that `this.length <= MAX_UINT32` since it's a read-only\n // property of a typed array.\n\n // This
behaves neither like String nor Uint8Array in that we set start/end\n // to their upper/lower bounds if the value
passed is out of range.\n // undefined is handled specially as per ECMA-262 6th Edition,\n // Section 13.3.3.7
Runtime Semantics: KeyedBindingInitialization.\n if (start === undefined || start < 0) {\n  start = 0\n }\n // Return
early if start > this.length. Done here to prevent potential uint32\n // coercion fail below.\n if (start > this.length)
{\n  return "\n }\n\n if (end === undefined || end > this.length) {\n  end = this.length\n }\n\n if (end <= 0) {\n
return "\n }\n\n // Force coercion to uint32. This will also coerce falsey/NaN values to 0.\n end >>>= 0\n start
>>>= 0\n\n if (end <= start) {\n  return "\n }\n\n if (!encoding) encoding = 'utf8'\n\n while (true) {\n  switch
(encoding) {\n   case 'hex':\n    return
hexSlice(this, start, end)\n\n   case 'utf8':\n   case 'utf-8':\n    return utf8Slice(this, start, end)\n\n   case
'ascii':\n    return asciiSlice(this, start, end)\n\n   case 'latin1':\n   case 'binary':\n    return latin1Slice(this,
start, end)\n\n   case 'base64':\n    return base64Slice(this, start, end)\n\n   case 'ucs2':\n   case 'ucs-2':\n
case 'utf16le':\n   case 'utf-16le':\n    return utf16leSlice(this, start, end)\n\n   default:\n    if (loweredCase)
throw new TypeError('Unknown encoding: ' + encoding)\n    encoding = (encoding + '').toLowerCase()\n    loweredCase = true\n  }\n }\n\n\n// The property is used by `Buffer.isBuffer` and `is-buffer` (in Safari 5-7) to
detect\n// Buffer instances.\nBuffer.prototype._isBuffer = true\n\nfunction swap (b, n, m) {\n  var i = b[n]\n  b[n] =
b[m]\n  b[m] = i\n}\n\nBuffer.prototype.swap16 = function swap16 () {\n  var len = this.length\n  if (len % 2 !== 0)
{\n
throw new RangeError('Buffer size must be a multiple of 16-bits')\n }\n  for (var i = 0; i < len; i += 2) {\n
swap(this, i, i + 1)\n }\n  return this\n}\n\nBuffer.prototype.swap32 = function swap32 () {\n  var len = this.length\n
if (len % 4 !== 0) {\n  throw new RangeError('Buffer size must be a multiple of 32-bits')\n }\n  for (var i = 0; i <
len; i += 4) {\n  swap(this, i, i + 3)\n  swap(this, i + 1, i + 2)\n }\n  return this\n}\n\nBuffer.prototype.swap64 =
function swap64 () {\n  var len = this.length\n  if (len % 8 !== 0) {\n  throw new RangeError('Buffer size must be a
multiple of 64-bits')\n }\n  for (var i = 0; i < len; i += 8) {\n  swap(this, i, i + 7)\n  swap(this, i + 1, i + 6)\n
swap(this, i + 2, i + 5)\n  swap(this, i + 3, i + 4)\n }\n  return this\n}\n\nBuffer.prototype.toString = function
toString () {\n  var length = this.length | 0\n  if (length === 0) return "\n  if (arguments.length === 0) return
utf8Slice(this, 0, length)\n  return slowToString.apply(this,
arguments)\n}\n\nBuffer.prototype.equals = function equals (b) {\n  if (!Buffer.isBuffer(b)) throw new
TypeError('Argument must be a Buffer')\n  if (this === b) return true\n  return Buffer.compare(this, b) ===
0\n}\n\nBuffer.prototype.inspect = function inspect () {\n  var str = "\n  var max =
exports.INSPECT_MAX_BYTES\n  if (this.length > 0) {\n  str = this.toString('hex', 0, max).match(/.{2}/g).join('
')\n  if (this.length > max) str += ' ... '\n }\n  return '<Buffer ' + str + '>'\n}\n\nBuffer.prototype.compare = function
compare (target, start, end, thisStart, thisEnd) {\n  if (!Buffer.isBuffer(target)) {\n  throw new
TypeError('Argument must be a Buffer')\n }\n\n  if (start === undefined) {\n  start = 0\n }\n  if (end ===
undefined) {\n  end = target ? target.length : 0\n }\n  if (thisStart === undefined) {\n  thisStart = 0\n }\n  if
(thisEnd === undefined) {\n  thisEnd = this.length\n }\n\n  if (start < 0 || end > target.length || thisStart
< 0 || thisEnd > this.length) {\n  throw new RangeError('out of range index')\n }\n\n  if (thisStart >= thisEnd &&
start >= end) {\n  return 0\n }\n  if (thisStart >= thisEnd) {\n  return -1\n }\n  if (start >= end) {\n  return 1\n
}\n\n  start >>>= 0\n  end >>>= 0\n  thisStart >>>= 0\n  thisEnd >>>= 0\n  if (this === target) return 0\n  var x =
thisEnd - thisStart\n  var y = end - start\n  var len = Math.min(x, y)\n  var thisCopy = this.slice(thisStart,
thisEnd)\n  var targetCopy = target.slice(start, end)\n  for (var i = 0; i < len; ++i) {\n  if (thisCopy[i] !==
targetCopy[i]) {\n  x = thisCopy[i]\n  y = targetCopy[i]\n  break\n }\n }\n\n  if (x < y) return -1\n  if (y <
x) return 1\n  return 0\n}\n\n\n// Finds either the first index of `val` in `buffer` at offset >= `byteOffset`,\n\n// OR the last
index of `val` in `buffer` at offset <= `byteOffset`.\n\n// Arguments:\n\n// - buffer - a Buffer to search\n\n// - val - a
string, Buffer, or number\n\n// -
byteOffset - an index into `buffer`; will be clamped to an int32\n\n// - encoding - an optional encoding, relevant if val
is a string\n\n// - dir - true for indexOf, false for lastIndexOf\n\nfunction bidirectionalIndexOf (buffer, val, byteOffset,

```



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encoding, dir) {\n // Empty buffer means no match\n if (buffer.length === 0) return -1\n\n // Normalize
byteOffset\n if (typeof byteOffset === 'string') {\n encoding = byteOffset\n byteOffset = 0\n } else if
(byteOffset > 0x7fffffff) {\n byteOffset = 0x7fffffff\n } else if (byteOffset < -0x80000000) {\n byteOffset = -
0x80000000\n }\n byteOffset = +byteOffset // Coerce to Number.\n if (isNaN(byteOffset)) {\n // byteOffset: it
it's undefined, null, NaN, \"foo\", etc, search whole buffer\n byteOffset = dir ? 0 : (buffer.length - 1)\n }\n\n //
Normalize byteOffset: negative offsets start from the end of the buffer\n if (byteOffset < 0) byteOffset =
buffer.length + byteOffset\n if (byteOffset >= buffer.length) {\n if (dir)
return -1\n else byteOffset = buffer.length - 1\n } else if (byteOffset < 0) {\n if (dir) byteOffset = 0\n else
return -1\n }\n\n // Normalize val\n if (typeof val === 'string') {\n val = Buffer.from(val, encoding)\n }\n\n //
Finally, search either indexOf (if dir is true) or lastIndexOf\n if (Buffer.isBuffer(val)) {\n // Special case: looking
for empty string/buffer always fails\n if (val.length === 0) {\n return -1\n }\n return arrayIndexOf(buffer,
val, byteOffset, encoding, dir)\n } else if (typeof val === 'number') {\n val = val & 0xFF // Search for a byte value
[0-255]\n if (Buffer.TYPED_ARRAY_SUPPORT &&\n typeof Uint8Array.prototype.indexOf === 'function')
{\n if (dir) {\n return Uint8Array.prototype.indexOf.call(buffer, val, byteOffset)\n } else {\n return
Uint8Array.prototype.lastIndexOf.call(buffer, val, byteOffset)\n }\n }\n return arrayIndexOf(buffer, [ val ],
byteOffset, encoding, dir)\n
}\n\n throw new TypeError('val must be string, number or Buffer')\n}\n\nfunction arrayIndexOf (arr, val,
byteOffset, encoding, dir) {\n var indexSize = 1\n var arrLength = arr.length\n var valLength = val.length\n\n if
(encoding !== undefined) {\n encoding = String(encoding).toLowerCase()\n if (encoding === 'ucs2' || encoding
=== 'ucs-2' ||\n encoding === 'utf16le' || encoding === 'utf-16le') {\n if (arr.length < 2 || val.length < 2) {\n
return -1\n }\n indexSize = 2\n arrLength /= 2\n valLength /= 2\n byteOffset /= 2\n }\n }\n\n
function read (buf, i) {\n if (indexSize === 1) {\n return buf[i]\n } else {\n return buf.readUInt16BE(i *
indexSize)\n }\n }\n\n var i\n if (dir) {\n var foundIndex = -1\n for (i = byteOffset; i < arrLength; i++) {\n
if (read(arr, i) === read(val, foundIndex === -1 ? 0 : i - foundIndex)) {\n if (foundIndex === -1) foundIndex =
i\n if (i - foundIndex +
1 === valLength) return foundIndex * indexSize\n } else {\n if (foundIndex !== -1) i -= i - foundIndex\n
foundIndex = -1\n }\n }\n } else {\n if (byteOffset + valLength > arrLength) byteOffset = arrLength -
valLength\n for (i = byteOffset; i >= 0; i--) {\n var found = true\n for (var j = 0; j < valLength; j++) {\n
if (read(arr, i + j) !== read(val, j)) {\n found = false\n break\n }\n }\n if (found) return i\n }\n }\n
return -1\n}\n\nBuffer.prototype.includes = function includes (val, byteOffset, encoding) {\n return
this.indexOf(val, byteOffset, encoding) !== -1\n}\n\nBuffer.prototype.indexOf = function indexOf (val, byteOffset,
encoding) {\n return bidirectionalIndexOf(this, val, byteOffset, encoding, true)\n}\n\nBuffer.prototype.lastIndexOf
= function lastIndexOf (val, byteOffset, encoding) {\n return bidirectionalIndexOf(this, val, byteOffset, encoding,
false)\n}\n\nfunction hexWrite (buf,
string, offset, length) {\n offset = Number(offset) || 0\n var remaining = buf.length - offset\n if (!length) {\n
length = remaining\n } else {\n length = Number(length)\n if (length > remaining) {\n length = remaining\n
}\n }\n\n // must be an even number of digits\n var strLen = string.length\n if (strLen % 2 !== 0) throw new
TypeError('Invalid hex string')\n\n if (length > strLen / 2) {\n length = strLen / 2\n }\n for (var i = 0; i < length;
++i) {\n var parsed = parseInt(string.substr(i * 2, 2), 16)\n if (isNaN(parsed)) return i\n buf[offset + i] =
parsed\n }\n return i\n}\n\nfunction utf8Write (buf, string, offset, length) {\n return blitBuffer(utf8ToBytes(string),
buf.length - offset, buf, offset, length)\n}\n\nfunction asciiWrite (buf, string, offset, length) {\n return
blitBuffer(asciiToBytes(string), buf, offset, length)\n}\n\nfunction latin1Write (buf, string, offset, length) {\n return
asciiWrite(buf, string, offset, length)\n}\n\nfunction
base64Write (buf, string, offset, length) {\n return blitBuffer(base64ToBytes(string), buf, offset,
length)\n}\n\nfunction ucs2Write (buf, string, offset, length) {\n return blitBuffer(utf16leToBytes(string), buf.length
- offset, buf, offset, length)\n}\n\nBuffer.prototype.write = function write (string, offset, length, encoding) {\n //
Buffer#write(string)\n if (offset === undefined) {\n encoding = 'utf8'\n length = this.length\n offset = 0\n //
Buffer#write(string, encoding)\n } else if (length === undefined && typeof offset === 'string') {\n encoding =

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offset\n length = this.length\n offset = 0\n // Buffer#write(string, offset[, length][, encoding])\n } else if
(isFinite(offset)) {\n offset = offset | 0\n if (isFinite(length)) {\n length = length | 0\n if (encoding ===
undefined) encoding = 'utf8'\n } else {\n encoding = length\n length = undefined\n }\n // legacy
write(string, encoding, offset, length) - remove
in v0.13\n } else {\n throw new Error(\n 'Buffer.write(string, encoding, offset[, length]) is no longer
supported'\n )\n }\n\n var remaining = this.length - offset\n if (length === undefined || length > remaining) length
= remaining\n\n if ((string.length > 0 && (length < 0 || offset < 0)) || offset > this.length) {\n throw new
RangeError('Attempt to write outside buffer bounds')\n }\n\n if (!encoding) encoding = 'utf8'\n\n var loweredCase
= false\n for (;;) {\n switch (encoding) {\n case 'hex':\n return hexWrite(this, string, offset, length)\n\n
case 'utf8':\n case 'utf-8':\n return utf8Write(this, string, offset, length)\n\n case 'ascii':\n return
asciiWrite(this, string, offset, length)\n\n case 'latin1':\n case 'binary':\n return latin1Write(this, string,
offset, length)\n\n case 'base64':\n // Warning: maxLength not taken into account in base64Write\n
return base64Write(this, string,
offset, length)\n\n case 'ucs2':\n case 'ucs-2':\n case 'utf16le':\n case 'utf-16le':\n return
ucs2Write(this, string, offset, length)\n\n default:\n if (loweredCase) throw new TypeError('Unknown
encoding: ' + encoding)\n encoding = (' + encoding).toLowerCase()\n loweredCase = true\n }\n
}\n\n\nBuffer.prototype.toJSON = function toJSON () {\n return {\n type: 'Buffer',\n data:
Array.prototype.slice.call(this._arr || this, 0)\n }\n}\n\nfunction base64Slice (buf, start, end) {\n if (start === 0 &&
end === buf.length) {\n return base64.fromByteArray(buf)\n } else {\n return
base64.fromByteArray(buf.slice(start, end))\n }\n}\n\nfunction utf8Slice (buf, start, end) {\n end =
Math.min(buf.length, end)\n var res = []\n var i = start\n while (i < end) {\n var firstByte = buf[i]\n var
codePoint = null\n var bytesPerSequence = (firstByte > 0xEF) ? 4\n : (firstByte > 0xDF) ? 3\n : (firstByte
> 0xBF) ? 2\n : 1\n\n if (i + bytesPerSequence <= end) {\n var secondByte, thirdByte, fourthByte,
tempCodePoint\n\n switch (bytesPerSequence) {\n case 1:\n if (firstByte < 0x80) {\n codePoint
= firstByte\n }\n break\n case 2:\n secondByte = buf[i + 1]\n if ((secondByte & 0xC0)
=== 0x80) {\n tempCodePoint = (firstByte & 0x1F) << 0x6 | (secondByte & 0x3F)\n if
(tempCodePoint > 0x7F) {\n codePoint = tempCodePoint\n }\n }\n break\n case 3:\n
secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n if ((secondByte & 0xC0) === 0x80 && (thirdByte
& 0xC0) === 0x80) {\n tempCodePoint = (firstByte & 0xF) << 0xC | (secondByte & 0x3F) << 0x6 |
(thirdByte & 0x3F)\n if (tempCodePoint > 0x7FF && (tempCodePoint < 0xD800 || tempCodePoint >
0xDFFF)) {\n codePoint = tempCodePoint\n }\n }\n break\n case 4:\n secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n
fourthByte = buf[i + 3]\n if ((secondByte & 0xC0) === 0x80 && (thirdByte & 0xC0) === 0x80 &&
(fourthByte & 0xC0) === 0x80) {\n tempCodePoint = (firstByte & 0xF) << 0x12 | (secondByte & 0x3F) <<
0xC | (thirdByte & 0x3F) << 0x6 | (fourthByte & 0x3F)\n if (tempCodePoint > 0xFFFF && tempCodePoint
< 0x110000) {\n codePoint = tempCodePoint\n }\n }\n }\n }\n\n if (codePoint === null)
{\n // we did not generate a valid codePoint so insert a\n // replacement char (U+FFFD) and advance only 1
byte\n codePoint = 0xFFFF\n bytesPerSequence = 1\n } else if (codePoint > 0xFFFF) {\n // encode to
utf16 (surrogate pair dance)\n codePoint -= 0x10000\n res.push(codePoint >>> 10 & 0x3FF | 0xD800)\n
codePoint = 0xDC00 | codePoint & 0x3FF\n }\n\n res.push(codePoint)\n
i += bytesPerSequence\n }\n\n return decodeCodePointsArray(res)\n}\n\n// Based on
http://stackoverflow.com/a/22747272/680742, the browser with\n// the lowest limit is Chrome, with 0x10000
args.\n// We go 1 magnitude less, for safety\nvar MAX_ARGUMENTS_LENGTH = 0x1000\n\nfunction
decodeCodePointsArray (codePoints) {\n var len = codePoints.length\n if (len <=
MAX_ARGUMENTS_LENGTH) {\n return String.fromCharCode.apply(String, codePoints) // avoid extra
slice()\n }\n\n // Decode in chunks to avoid \"call stack size exceeded\"\n var res = \"\n var i = 0\n while (i < len)
{\n res += String.fromCharCode.apply(\n String,\n codePoints.slice(i, i +=
MAX_ARGUMENTS_LENGTH)\n )\n }\n\n return res\n}\n\nfunction asciiSlice (buf, start, end) {\n var ret = \"\n

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end = Math.min(buf.length, end)\n\n for (var i = start; i < end; ++i) {\n  ret += String.fromCharCode(buf[i] &
0x7F)\n }\n return ret\n}\n\nfunction latin1Slice (buf, start, end) {\n  var ret = "\n
  end = Math.min(buf.length, end)\n\n for (var i = start; i < end; ++i) {\n  ret += String.fromCharCode(buf[i])\n
}\n  return ret\n}\n\nfunction hexSlice (buf, start, end) {\n  var len = buf.length\n\n if (!start || start < 0) start = 0\n
if (!end || end < 0 || end > len) end = len\n\n  var out = "\n\n for (var i = start; i < end; ++i) {\n  out +=
toHex(buf[i])\n }\n  return out\n}\n\nfunction utf16leSlice (buf, start, end) {\n  var bytes = buf.slice(start, end)\n
var res = "\n\n for (var i = 0; i < bytes.length; i += 2) {\n  res += String.fromCharCode(bytes[i] + bytes[i + 1] *
256)\n }\n  return res\n}\n\nBuffer.prototype.slice = function slice (start, end) {\n  var len = this.length\n  start =
~~start\n  end = end === undefined ? len : ~~end\n\n if (start < 0) {\n  start += len\n  if (start < 0) start = 0\n }
else if (start > len) {\n  start = len\n }\n\n if (end < 0) {\n  end += len\n  if (end < 0) end = 0\n } else if (end >
len) {\n  end = len\n }\n\n  if (end < start) end = start\n\n  var newBuf\n  if (Buffer.TYPED_ARRAY_SUPPORT) {\n  newBuf =
this.subarray(start, end)\n  newBuf.__proto__ = Buffer.prototype\n } else {\n  var sliceLen = end - start\n
newBuf = new Buffer(sliceLen, undefined)\n  for (var i = 0; i < sliceLen; ++i) {\n  newBuf[i] = this[i + start]\n
}\n }\n\n  return newBuf\n}\n\n/*\n * Need to make sure that buffer isn't trying to write out of bounds.\n
*/\nfunction checkOffset (offset, ext, length) {\n  if ((offset % 1) !== 0 || offset < 0) throw new RangeError('offset is
not uint')\n  if (offset + ext > length) throw new RangeError('Trying to access beyond buffer
length')\n}\n\nBuffer.prototype.readUIntLE = function readUIntLE (offset, byteLength, noAssert) {\n  offset =
offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset, byteLength, this.length)\n\n  var val =
this[offset]\n  var mul = 1\n  var i = 0\n  while (++i < byteLength && (mul *= 0x100)) {\n  val += this[offset
+ i] * mul\n }\n\n  return val\n}\n\nBuffer.prototype.readUIntBE = function readUIntBE (offset, byteLength,
noAssert) {\n  offset = offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) {\n  checkOffset(offset,
byteLength, this.length)\n }\n\n  var val = this[offset + --byteLength]\n  var mul = 1\n  while (byteLength > 0 &&
(mul *= 0x100)) {\n  val += this[offset + --byteLength] * mul\n }\n\n  return val\n}\n\nBuffer.prototype.readUInt8
= function readUInt8 (offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 1, this.length)\n  return
this[offset]\n}\n\nBuffer.prototype.readUInt16LE = function readUInt16LE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  return this[offset] | (this[offset + 1] <<
8)\n}\n\nBuffer.prototype.readUInt16BE = function readUInt16BE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  return (this[offset] << 8) | this[offset + 1]\n}\n\nBuffer.prototype.readUInt32LE
= function readUInt32LE
(offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 4, this.length)\n\n  return ((this[offset]) |\n  (this[offset +
1] << 8) |\n  (this[offset + 2] << 16)) +\n  (this[offset + 3] * 0x1000000)\n}\n\nBuffer.prototype.readUInt32BE
= function readUInt32BE (offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 4, this.length)\n\n  return
(this[offset] * 0x1000000) +\n  ((this[offset + 1] << 16) |\n  (this[offset + 2] << 8) |\n  this[offset +
3])\n}\n\nBuffer.prototype.readIntLE = function readIntLE (offset, byteLength, noAssert) {\n  offset = offset | 0\n
byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset, byteLength, this.length)\n\n  var val =
this[offset]\n  var mul = 1\n  var i = 0\n  while (++i < byteLength && (mul *= 0x100)) {\n  val += this[offset + i] *
mul\n }\n  mul *= 0x80\n\n  if (val >= mul) val -= Math.pow(2, 8 * byteLength)\n\n  return
val\n}\n\nBuffer.prototype.readIntBE = function readIntBE (offset, byteLength, noAssert)
{\n  offset = offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset, byteLength,
this.length)\n\n  var i = byteLength\n  var mul = 1\n  var val = this[offset + --i]\n  while (i > 0 && (mul *= 0x100))
{\n  val += this[offset + --i] * mul\n }\n  mul *= 0x80\n\n  if (val >= mul) val -= Math.pow(2, 8 * byteLength)\n\n
return val\n}\n\nBuffer.prototype.readInt8 = function readInt8 (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 1, this.length)\n  if (!(this[offset] & 0x80)) return (this[offset])\n  return ((0xff - this[offset] + 1)
* -1)\n}\n\nBuffer.prototype.readInt16LE = function readInt16LE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  var val = this[offset] | (this[offset + 1] << 8)\n  return (val & 0x8000) ? val |
0xFFFF0000 : val\n}\n\nBuffer.prototype.readInt16BE = function readInt16BE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  var val = this[offset + 1] | (this[offset] << 8)\n

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return (val & 0x8000) ? val | 0xFFFF0000 : val\n}\n\nBuffer.prototype.readInt32LE = function readInt32LE
(offset, noAssert) {\n if (!noAssert) checkOffset(offset, 4, this.length)\n\n return (this[offset]) |\n (this[offset + 1]
<< 8) |\n (this[offset + 2] << 16) |\n (this[offset + 3] << 24)\n}\n\nBuffer.prototype.readInt32BE = function
readInt32BE (offset, noAssert) {\n if (!noAssert) checkOffset(offset, 4, this.length)\n\n return (this[offset] << 24)
|\n (this[offset + 1] << 16) |\n (this[offset + 2] << 8) |\n (this[offset + 3])\n}\n\nBuffer.prototype.readFloatLE =
function readFloatLE (offset, noAssert) {\n if (!noAssert) checkOffset(offset, 4, this.length)\n\n return
ieee754.read(this, offset, true, 23, 4)\n}\n\nBuffer.prototype.readFloatBE = function readFloatBE (offset, noAssert)
{\n if (!noAssert) checkOffset(offset, 4, this.length)\n\n return ieee754.read(this, offset, false, 23,
4)\n}\n\nBuffer.prototype.readDoubleLE = function readDoubleLE (offset, noAssert)
{\n if (!noAssert) checkOffset(offset, 8, this.length)\n\n return ieee754.read(this, offset, true, 52,
8)\n}\n\nBuffer.prototype.readDoubleBE = function readDoubleBE (offset, noAssert) {\n if (!noAssert)
checkOffset(offset, 8, this.length)\n\n return ieee754.read(this, offset, false, 52, 8)\n}\n\nfunction checkInt (buf,
value, offset, ext, max, min) {\n if (!Buffer.isBuffer(buf)) throw new TypeError("\buffer" argument must be a
Buffer instance)\n if (value > max || value < min) throw new RangeError("\value" argument is out of bounds)\n if
(offset + ext > buf.length) throw new RangeError('Index out of range')\n}\n\nBuffer.prototype.writeUIntLE =
function writeUIntLE (value, offset, byteLength, noAssert) {\n value = +value\n offset = offset | 0\n byteLength =
byteLength | 0\n if (!noAssert) {\n var maxBytes = Math.pow(2, 8 * byteLength) - 1\n checkInt(this, value,
offset, byteLength, maxBytes, 0)\n }\n\n var mul = 1\n var i = 0\n this[offset] = value & 0xFF\n
while (++i < byteLength && (mul *= 0x100)) {\n this[offset + i] = (value / mul) & 0xFF\n }\n\n return offset +
byteLength\n}\n\nBuffer.prototype.writeUIntBE = function writeUIntBE (value, offset, byteLength, noAssert) {\n
value = +value\n offset = offset | 0\n byteLength = byteLength | 0\n if (!noAssert) {\n var maxBytes =
Math.pow(2, 8 * byteLength) - 1\n checkInt(this, value, offset, byteLength, maxBytes, 0)\n }\n\n var i =
byteLength - 1\n var mul = 1\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *= 0x100)) {\n
this[offset + i] = (value / mul) & 0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeUInt8 =
function writeUInt8 (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this,
value, offset, 1, 0xff, 0)\n if (!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n this[offset] =
(value & 0xff)\n\n return offset + 1\n}\n\nfunction objectWriteUInt16 (buf, value, offset, littleEndian)
{\n if (value < 0) value = 0xffff + value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 2); i < j; ++i) {\n
buf[offset + i] = (value & (0xff << (8 * (littleEndian ? i : 1 - i)))) >>>\n (littleEndian ? i : 1 - i) * 8\n
}\n}\n\nBuffer.prototype.writeUInt16LE = function writeUInt16LE (value, offset, noAssert) {\n value = +value\n
offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0xffff, 0)\n if
(Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n }
else {\n objectWriteUInt16(this, value, offset, true)\n }\n\n return offset + 2\n}\n\nBuffer.prototype.writeUInt16BE
= function writeUInt16BE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 2, 0xffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>>
8)\n this[offset + 1] = (value & 0xff)\n } else {\n objectWriteUInt16(this, value, offset, false)\n
}\n\n return offset + 2\n}\n\nfunction objectWriteUInt32 (buf, value, offset, littleEndian) {\n if (value < 0) value =
0xffffffff + value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 4); i < j; ++i) {\n buf[offset + i] = (value
>>> (littleEndian ? i : 3 - i) * 8) & 0xff\n }\n}\n\nBuffer.prototype.writeUInt32LE = function writeUInt32LE
(value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4,
0xffffffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset + 3] = (value >>> 24)\n this[offset + 2]
= (value >>> 16)\n this[offset + 1] = (value >>> 8)\n this[offset] = (value & 0xff)\n } else {\n
objectWriteUInt32(this, value, offset, true)\n }\n\n return offset + 4\n}\n\nBuffer.prototype.writeUInt32BE =
function writeUInt32BE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 4, 0xffffffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT)
{\n this[offset] = (value >>> 24)\n this[offset + 1] = (value >>> 16)\n this[offset + 2] = (value >>> 8)\n
this[offset + 3] = (value & 0xff)\n } else {\n objectWriteUInt32(this, value, offset, false)\n }\n\n return offset +
4\n}\n\nBuffer.prototype.writeIntLE = function writeIntLE (value, offset, byteLength, noAssert) {\n value =

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+value\n offset = offset | 0\n if (!noAssert) {\n   var limit = Math.pow(2, 8 * byteLength - 1)\n   checkInt(this,
value, offset, byteLength, limit - 1, -limit)\n } \n\n var i = 0\n var mul = 1\n var sub = 0\n this[offset] = value &
0xFF\n while (++i < byteLength && (mul *= 0x100)) {\n   if (value < 0 && sub === 0 && this[offset + i - 1] !==
0) {\n     sub = 1\n   }\n   this[offset + i] = ((value / mul) >> 0) - sub & 0xFF\n }\n\n return offset +
byteLength\n}\n\nBuffer.prototype.writeIntBE = function writeIntBE (value, offset, byteLength, noAssert) {\n
value = +value\n offset = offset | 0\n if (!noAssert) {\n   var limit
= Math.pow(2, 8 * byteLength - 1)\n   checkInt(this, value, offset, byteLength, limit - 1, -limit)\n } \n\n var i =
byteLength - 1\n var mul = 1\n var sub = 0\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *=
0x100)) {\n   if (value < 0 && sub === 0 && this[offset + i + 1] !== 0) {\n     sub = 1\n   }\n   this[offset + i] =
((value / mul) >> 0) - sub & 0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeInt8 = function
writeInt8 (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value,
offset, 1, 0x7f, -0x80)\n if (!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n if (value < 0) value
= 0xff + value + 1\n this[offset] = (value & 0xff)\n return offset + 1\n}\n\nBuffer.prototype.writeInt16LE =
function writeInt16LE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 2, 0x7fff, -0x8000)\n if (Buffer.TYPED_ARRAY_SUPPORT)
{\n   this[offset] = (value & 0xff)\n   this[offset + 1] = (value >>> 8)\n } else {\n   objectWriteUInt16(this, value,
offset, true)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeInt16BE = function writeInt16BE (value, offset,
noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0x7fff, -0x8000)\n
if (Buffer.TYPED_ARRAY_SUPPORT) {\n   this[offset] = (value >>> 8)\n   this[offset + 1] = (value & 0xff)\n }
else {\n   objectWriteUInt16(this, value, offset, false)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeInt32LE
= function writeInt32LE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 4, 0x7fffffff, -0x80000000)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n
this[offset] = (value & 0xff)\n   this[offset + 1] = (value >>> 8)\n   this[offset + 2] = (value >>> 16)\n   this[offset
+ 3] = (value >>> 24)\n } else {\n   objectWriteUInt32(this, value,
offset, true)\n }\n return offset + 4\n}\n\nBuffer.prototype.writeInt32BE = function writeInt32BE (value, offset,
noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4, 0x7fffffff, -
0x80000000)\n if (value < 0) value = 0xffffffff + value + 1\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n
this[offset] = (value >>> 24)\n   this[offset + 1] = (value >>> 16)\n   this[offset + 2] = (value >>> 8)\n   this[offset
+ 3] = (value & 0xff)\n } else {\n   objectWriteUInt32(this, value, offset, false)\n }\n return offset +
4\n}\n\nfunction checkIEEE754 (buf, value, offset, ext, max, min) {\n if (offset + ext > buf.length) throw new
RangeError('Index out of range')\n if (offset < 0) throw new RangeError('Index out of range')\n}\n\nfunction
writeFloat (buf, value, offset, littleEndian, noAssert) {\n if (!noAssert) {\n   checkIEEE754(buf, value, offset, 4,
3.4028234663852886e+38, -3.4028234663852886e+38)\n }\n ieee754.write(buf, value, offset,
littleEndian, 23, 4)\n return offset + 4\n}\n\nBuffer.prototype.writeFloatLE = function writeFloatLE (value, offset,
noAssert) {\n return writeFloat(this, value, offset, true, noAssert)\n}\n\nBuffer.prototype.writeFloatBE = function
writeFloatBE (value, offset, noAssert) {\n return writeFloat(this, value, offset, false, noAssert)\n}\n\nfunction
writeDouble (buf, value, offset, littleEndian, noAssert) {\n if (!noAssert) {\n   checkIEEE754(buf, value, offset, 8,
1.7976931348623157E+308, -1.7976931348623157E+308)\n }\n ieee754.write(buf, value, offset, littleEndian, 52,
8)\n return offset + 8\n}\n\nBuffer.prototype.writeDoubleLE = function writeDoubleLE (value, offset, noAssert)
{\n return writeDouble(this, value, offset, true, noAssert)\n}\n\nBuffer.prototype.writeDoubleBE = function
writeDoubleBE (value, offset, noAssert) {\n return writeDouble(this, value, offset, false, noAssert)\n}\n\n//
copy(targetBuffer, targetStart=0, sourceStart=0, sourceEnd=buffer.length)\nBuffer.prototype.copy
= function copy (target, targetStart, start, end) {\n if (!start) start = 0\n if (!end && end !== 0) end = this.length\n
if (targetStart >= target.length) targetStart = target.length\n if (!targetStart) targetStart = 0\n if (end > 0 && end <
start) end = start\n\n // Copy 0 bytes; we're done\n if (end === start) return 0\n if (target.length === 0 || this.length
=== 0) return 0\n\n // Fatal error conditions\n if (targetStart < 0) {\n   throw new RangeError('targetStart out of
bounds')\n }\n if (start < 0 || start >= this.length) throw new RangeError('sourceStart out of bounds')\n if (end < 0)
throw new RangeError('sourceEnd out of bounds')\n\n // Are we oob?\n if (end > this.length) end = this.length\n if

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i = 0; i < str.length; ++i) {\n // Node's code seems to be doing this and not & 0x7F.\n
byteArray.push(str.charCodeAtAt(i) & 0xFF)\n }\n return byteArray\n}\n\nfunction utf16leToBytes (str, units) {\n
var c, hi, lo\n var byteArray = []\n for (var i = 0; i < str.length; ++i) {\n if ((units -= 2) < 0) break\n\n c =
str.charCodeAtAt(i)\n hi = c >> 8\n lo = c % 256\n byteArray.push(lo)\n byteArray.push(hi)\n }\n\n return
byteArray\n}\n\nfunction base64ToBytes (str) {\n return base64.toByteArray(base64clean(str))\n}\n\nfunction
blitBuffer (src, dst, offset, length) {\n for (var i = 0; i < length; ++i) {\n if ((i + offset >= dst.length) || (i >=
src.length)) break\n dst[i + offset] = src[i]\n }\n return i\n}\n\nfunction isnan (val) {\n return val !== val // eslint-
disable-line no-self-compare\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {complex} from './ops/complex';\nimport {tensor} from './ops/tensor';\nimport {NamedTensor,
NamedTensorMap} from './tensor_types';\nimport {TypedArray} from './types';\nimport {sizeFromShape} from
'./util';\nimport {DTYPE_VALUE_SIZE_MAP, ModelArtifacts, ModelArtifactsInfo, WeightGroup,
WeightsManifestEntry} from './types';\n\n/** Number of bytes reserved for the length of the string. (32bit integer).
*\n\nconst
NUM_BYTES_STRING_LENGTH = 4;\n\n/**\n * Encode a map from names to weight values as an ArrayBuffer,
along with an\n * `Array` of `WeightsManifestEntry` as specification of the encoded weights.\n * \n * This function
does not perform sharding.\n * \n * This function is the reverse of `decodeWeights`.\n * \n * @param tensors A map
(`dict`) from names to tensors.\n * @param group Group to which the weights belong (optional).\n * @returns A
`Promise` of\n * - A flat `ArrayBuffer` with all the binary values of the `Tensor`s\n * concatenated.\n * - An
`Array` of `WeightManifestEntry`s, carrying information including\n * tensor names, `dtype`s and shapes.\n *
@throws Error: on unsupported tensor `dtype`.\n */\nexport async function encodeWeights(\n tensors:
NamedTensorMap|NamedTensor[], group?: WeightGroup): Promise<{data: ArrayBuffer, specs:
WeightsManifestEntry[]}> {\n // TODO(adarob, cais): Support quantization.\n const specs:
WeightsManifestEntry[] = [];\n const dataPromises:
Array<Promise<TypedArray>> = [];\n\n const names: string[] = Array.isArray(tensors) ?\n tensors.map(tensor
=> tensor.name) :\n Object.keys(tensors);\n\n for (let i = 0; i < names.length; ++i) {\n const name =
names[i];\n const t = Array.isArray(tensors) ? tensors[i].tensor : tensors[name];\n if (t.dtype !== 'float32' &&
t.dtype !== 'int32' && t.dtype !== 'bool' &&\n t.dtype !== 'string' && t.dtype !== 'complex64') {\n throw
new Error(`Unsupported dtype in weight '${name}': ${t.dtype}`);\n }\n const spec: WeightsManifestEntry =
{name, shape: t.shape, dtype: t.dtype};\n if (t.dtype === 'string') {\n const utf8bytes = new
Promise<TypedArray>(async resolve => {\n const vals = await t.bytes() as Uint8Array[];\n const
totalNumBytes = vals.reduce((p, c) => p + c.length, 0) +\n NUM_BYTES_STRING_LENGTH *\n vals.length;\n const bytes = new Uint8Array(totalNumBytes);\n let offset = 0;\n for (let
i = 0; i < vals.length; i++) {\n const val = vals[i];\n const bytesOfLength =\n new
Uint8Array(new Uint32Array([val.length]).buffer);\n bytes.set(bytesOfLength, offset);\n offset +=
NUM_BYTES_STRING_LENGTH;\n bytes.set(val, offset);\n offset += val.length;\n }\n
resolve(bytes);\n });\n dataPromises.push(utf8bytes);\n } else {\n dataPromises.push(t.data());\n }\n if
(group != null) {\n spec.group = group;\n }\n specs.push(spec);\n }\n\n const tensorValues = await
Promise.all(dataPromises);\n return {data: concatenateTypedArrays(tensorValues), specs};\n}\n\n/**\n * Decode
flat ArrayBuffer as weights.\n * \n * This function does not handle sharding.\n * \n * This function is the reverse of
`encodeWeights`.\n * \n * @param buffer A flat ArrayBuffer carrying the binary values of the tensors\n *
concatenated in the order specified in `specs`.\n * @param specs Specifications of

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the names, dtypes and shapes of the tensors\n * whose value are encoded by `buffer`.\n * @return A map from
tensor name to tensor value, with the names corresponding\n * to names in `specs`.\n * @throws Error, if any of
the tensors has unsupported dtype.\n */\nexport function decodeWeights(\n  buffer: ArrayBuffer, specs:
WeightsManifestEntry[]): NamedTensorMap {\n // TODO(adarob, cais): Support quantization.\n const out:
NamedTensorMap = {};\n let float16Decode: (buffer: Uint16Array) => Float32Array | undefined;\n let offset =
0;\n for (const spec of specs) {\n const name = spec.name;\n const dtype = spec.dtype;\n const shape =
spec.shape;\n const size = sizeFromShape(shape);\n let values: TypedArray|string[]|Uint8Array[];\n if
('quantization' in spec) {\n const quantization = spec.quantization;\n if (quantization.dtype === 'uint8' ||
quantization.dtype === 'uint16') {\n if (!(('min' in quantization && 'scale' in quantization)) {\n
throw new Error(\n `Weight ${spec.name} with quantization ${quantization.dtype} ` +\n `doesn't
have corresponding metadata min and scale.`);\n } else if (quantization.dtype === 'float16') {\n if
(dtype !== 'float32') {\n throw new Error(\n `Weight ${spec.name} is quantized with
${quantization.dtype} ` +\n `which only supports weights of type float32 not ${dtype}.`);\n } else {\n
throw new Error(\n `Weight ${spec.name} has unknown ` +\n `quantization dtype
${quantization.dtype}. ` +\n `Supported quantization dtypes are: ` +\n `uint8', 'uint16', and
'float16'.`);\n } } else {\n const quantizationSizeFactor = DTYPE_VALUE_SIZE_MAP[quantization.dtype];\n
const byteBuffer =\n buffer.slice(offset, offset + size * quantizationSizeFactor);\n const quantizedArray =
(quantization.dtype === 'uint8') ?\n new Uint8Array(byteBuffer)\n :\n new Uint16Array(byteBuffer);\n if (dtype === 'float32') {\n if (quantization.dtype === 'uint8' ||
quantization.dtype === 'uint16') {\n values = new Float32Array(quantizedArray.length);\n for (let i = 0; i
< quantizedArray.length; i++) {\n const v = quantizedArray[i];\n values[i] = v * quantization.scale +
quantization.min;\n } } else if (quantization.dtype === 'float16') {\n if (float16Decode ===
undefined) {\n float16Decode = getFloat16Decoder();\n } values =
float16Decode(quantizedArray as Uint16Array);\n } else {\n throw new Error(\n `Unsupported
quantization type ${quantization.dtype} ` +\n `for weight type float32.`);\n } } else if (dtype ===
'int32') {\n if (quantization.dtype !== 'uint8' && quantization.dtype !== 'uint16') {\n throw new Error(\n
`Unsupported quantization
type ${quantization.dtype} ` +\n `for weight type int32.`);\n } values = new
Int32Array(quantizedArray.length);\n for (let i = 0; i < quantizedArray.length; i++) {\n const v =
quantizedArray[i];\n values[i] = Math.round(v * quantization.scale + quantization.min);\n } } else {\n
throw new Error(`Unsupported dtype in weight '${name}': ${dtype}`);\n } offset += size *
quantizationSizeFactor;\n } else if (dtype === 'string') {\n const size = sizeFromShape(spec.shape);\n values
= [];\n for (let i = 0; i < size; i++) {\n const byteLength = new Uint32Array(\n buffer.slice(offset,
offset + NUM_BYTES_STRING_LENGTH))[0];\n offset += NUM_BYTES_STRING_LENGTH;\n const
bytes = new Uint8Array(buffer.slice(offset, offset + byteLength));\n (values as Uint8Array[]).push(bytes);\n
offset += byteLength;\n } } else {\n const dtypeFactor
= DTYPE_VALUE_SIZE_MAP[dtype];\n const byteBuffer = buffer.slice(offset, offset + size *
dtypeFactor);\n if (dtype === 'float32') {\n values = new Float32Array(byteBuffer);\n } else if (dtype
=== 'int32') {\n values = new Int32Array(byteBuffer);\n } else if (dtype === 'bool') {\n values = new
Uint8Array(byteBuffer);\n } else if (dtype === 'complex64') {\n values = new Float32Array(byteBuffer);\n
const real = new Float32Array(values.length / 2);\n const image = new Float32Array(values.length / 2);\n
for (let i = 0; i < real.length; i++) {\n real[i] = values[i * 2];\n image[i] = values[i * 2 + 1];\n } }\n
const realTensor = tensor(real, shape, 'float32');\n const imageTensor = tensor(image, shape, 'float32');\n
out[name] = complex(realTensor, imageTensor);\n realTensor.dispose();\n imageTensor.dispose();\n }
else {\n throw new Error(`Unsupported
dtype in weight '${name}': ${dtype}`);\n } offset += size * dtypeFactor;\n } }\n if (dtype !==
'complex64') {\n out[name] = tensor(values, shape, dtype);\n } }\n return out;\n}\n\n/**\n * Concatenate
TypedArrays into an ArrayBuffer.\n */\nexport function concatenateTypedArrays(xs: TypedArray[]): ArrayBuffer

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{\n // TODO(adarob, cais): Support quantization.\n if (xs === null) {\n   throw new Error('Invalid input value:
${JSON.stringify(xs)}');\n }\n\n let totalByteLength = 0;\n\n // `normalizedXs` is here for this reason: a
`TypedArray`'s `buffer`\n // can have a different byte length from that of the `TypedArray` itself,\n // for example,
when the `TypedArray` is created from an offset in an\n // `ArrayBuffer`. `normlializedXs` holds `TypedArray`s
whose `buffer`s match\n // the `TypedArray` in byte length. If an element of `xs` does not show\n // this property, a
new `TypedArray` that satisfy this property will be\n // constructed and pushed
into `normalizedXs`.\n const normalizedXs: TypedArray[] = [];\n xs.forEach((x: TypedArray) => {\n
totalByteLength += x.byteLength;\n // tslint:disable:no-any\n normalizedXs.push(\n   x.byteLength ===
x.buffer.byteLength ? x :\n                               new (x.constructor as any)(x);\n   if (!(x as any instanceof
Float32Array || x as any instanceof Int32Array ||\n     x as any instanceof Uint8Array)) {\n     throw new
Error('Unsupported TypedArray subtype: ${x.constructor.name}');\n   }\n // tslint:enable:no-any\n });\n\n const
y = new Uint8Array(totalByteLength);\n let offset = 0;\n normalizedXs.forEach((x: TypedArray) => {\n
y.set(new Uint8Array(x.buffer), offset);\n   offset += x.byteLength;\n });\n\n return y.buffer;\n}\n\n// Use Buffer
on Node.js instead of Blob/atob/btoa\nconst useNodeBuffer = typeof Buffer !== 'undefined' &&\n (typeof Blob
=== 'undefined' || typeof atob === 'undefined' ||\n   typeof btoa === 'undefined');\n\n/**\n * Calculate the byte length of a JavaScript string.\n */\n * Note that a JavaScript string can contain wide characters,
therefore the\n * length of the string is not necessarily equal to the byte length.\n */\n * @param str Input string.\n *
@return Byte length.\n */\nexport function stringByteLength(str: string): number {\n if (useNodeBuffer) {\n
return Buffer.byteLength(str);\n }\n return new Blob([str]).size;\n}\n\n/**\n * Encode an ArrayBuffer as a base64
encoded string.\n */\n * @param buffer `ArrayBuffer` to be converted.\n * @returns A string that base64-encodes
`buffer`.\n */\nexport function arrayBufferToBase64String(buffer: ArrayBuffer): string {\n if (useNodeBuffer) {\n
return Buffer.from(buffer).toString('base64');\n }\n const buf = new Uint8Array(buffer);\n let s = '';\n for (let i = 0,
l = buf.length; i < l; i++) {\n   s += String.fromCharCode(buf[i]);\n }\n return btoa(s);\n}\n\n/**\n * Decode a
base64 string as an ArrayBuffer.\n */\n * @param
str Base64 string.\n * @returns Decoded `ArrayBuffer`.\n */\nexport function base64StringToArrayBuffer(str:
string): ArrayBuffer {\n if (useNodeBuffer) {\n   const buf = Buffer.from(str, 'base64');\n   return
buf.buffer.slice(buf.byteOffset, buf.byteOffset + buf.byteLength);\n }\n const s = atob(str);\n const buffer = new
Uint8Array(s.length);\n for (let i = 0; i < s.length; ++i) {\n   buffer.set([s.charCodeAt(i)], i);\n }\n return
buffer.buffer;\n}\n\n/**\n * Concatenate a number of ArrayBuffers into one.\n */\n * @param buffers A number of
array buffers to concatenate.\n * @returns Result of concatenating `buffers` in order.\n */\nexport function
concatenateArrayBuffers(buffers: ArrayBuffer[]): ArrayBuffer {\n if (buffers.length === 1) {\n   return
buffers[0];\n }\n\n let totalByteLength = 0;\n buffers.forEach((buffer: ArrayBuffer) => {\n   totalByteLength +=
buffer.byteLength;\n });\n\n const temp = new Uint8Array(totalByteLength);\n let offset = 0;\n
buffers.forEach((buffer:
ArrayBuffer) => {\n   temp.set(new Uint8Array(buffer), offset);\n   offset += buffer.byteLength;\n });\n return
temp.buffer;\n}\n\n/**\n * Get the basename of a path.\n */\n * Behaves in a way analogous to Linux's basename
command.\n */\n * @param path\n */\nexport function basename(path: string): string {\n const SEPARATOR = '/';\n
path = path.trim();\n while (path.endsWith(SEPARATOR)) {\n   path = path.slice(0, path.length - 1);\n }\n const
items = path.split(SEPARATOR);\n return items[items.length - 1];\n}\n\n/**\n * Populate ModelArtifactsInfo
fields for a model with JSON topology.\n */\n * @param modelArtifacts\n * @returns A ModelArtifactsInfo object.\n
*/\nexport function getModelArtifactsInfoForJSON(modelArtifacts: ModelArtifacts): ModelArtifactsInfo {\n if
(modelArtifacts.modelTopology instanceof ArrayBuffer) {\n   throw new Error('Expected JSON model topology,
received ArrayBuffer.);\n }\n\n return {\n   dateSaved: new Date(),\n   modelTopologyType:
'JSON',\n   modelTopologyBytes: modelArtifacts.modelTopology === null ?\n     0 :\n     stringByteLength(JSON.stringify(modelArtifacts.modelTopology)),\n   weightSpecsBytes:
modelArtifacts.weightSpecs === null ?\n     0 :\n     stringByteLength(JSON.stringify(modelArtifacts.weightSpecs)),\n   weightDataBytes: modelArtifacts.weightData
=== null ?\n     0 :\n     modelArtifacts.weightData.byteLength,\n   };\n}\n\n/**\n * Computes mantisa table for

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casting Float16 to Float32\n * See http://www.fox-toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns
Uint32Array, 2048 mantissa lookup values.\n *\nfunction computeFloat16MantisaTable(): Uint32Array {\n const
convertMantissa = (i: number): number => {\n let m = i << 13;\n let e = 0;\n while ((m & 0x00800000) ===
0) {\n e -= 0x00800000;\n m <<= 1;\n }\n m &= ~0x00800000;\n e += 0x38800000;\n return m | e;\n
};\n\n const mantisaTable = new Uint32Array(2048);\n\n mantisaTable[0]
= 0;\n for (let i = 1; i < 1024; i++) {\n mantisaTable[i] = convertMantissa(i);\n }\n for (let i = 1024; i < 2048;
i++) {\n mantisaTable[i] = 0x38000000 + ((i - 1024) << 13);\n }\n\n return mantisaTable;\n}\n\n/**\n *
Computes exponent table for casting Float16 to Float32\n * See http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns Uint32Array, 64 exponent lookup values.\n *\nfunction
computeFloat16ExponentTable(): Uint32Array {\n const exponentTable = new Uint32Array(64);\n\n
exponentTable[0] = 0;\n exponentTable[31] = 0x47800000;\n exponentTable[32] = 0x80000000;\n
exponentTable[63] = 0xc7800000;\n for (let i = 1; i < 31; i++) {\n exponentTable[i] = i << 23;\n }\n for (let i =
33; i < 63; i++) {\n exponentTable[i] = 0x80000000 + ((i - 32) << 23);\n }\n\n return exponentTable;\n}\n\n/**\n *
Computes offset table for casting Float16 to Float32\n * See http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns Uint32Array,
6d offset values.\n *\nfunction computeFloat16OffsetTable(): Uint32Array {\n const offsetTable = new
Uint32Array(64);\n\n for (let i = 0; i < 64; i++) {\n offsetTable[i] = 1024;\n }\n\n offsetTable[0] = offsetTable[32]
= 0;\n\n return offsetTable;\n}\n\n/**\n * Retrieve a Float16 decoder which will decode a ByteArray of Float16
values\n * to a Float32Array.\n *\n * @returns Function (buffer: Uint16Array) => Float32Array which decodes\n *
the Uint16Array of Float16 bytes to a Float32Array.\n *\nexport function getFloat16Decoder(): (buffer:
Uint16Array) => Float32Array {\n // Algorithm is based off of\n // http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n // Cache lookup tables\n const mantisaTable =
computeFloat16MantisaTable();\n const exponentTable = computeFloat16ExponentTable();\n const offsetTable =
computeFloat16OffsetTable();\n\n return (quantizedArray: Uint16Array) => {\n const buffer = new
ArrayBuffer(4 * quantizedArray.length);\n\n const bufferUint32View = new Uint32Array(buffer);\n for (let index = 0; index < quantizedArray.length;
index++) {\n const float16Bits = quantizedArray[index];\n const float32Bits =\n
mantisaTable[offsetTable[float16Bits >> 10] + (float16Bits & 0x3ff)] +\n exponentTable[float16Bits >> 10];\n\n
bufferUint32View[index] = float32Bits;\n }\n\n return new Float32Array(buffer);\n }\n}\n\n"/**\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {IOHandler, LoadOptions} from './types';\n\nexport type IORouter = (url: string|string[], loadOptions?:
LoadOptions) =>\n IOHandler;\n\nexport class IORouterRegistry {\n // Singleton instance.\n private static
instance: IORouterRegistry;\n\n private saveRouters: IORouter[];\n private loadRouters: IORouter[];\n\n private
constructor() {\n this.saveRouters = [];\n this.loadRouters = [];\n }\n\n private static getInstance():
IORouterRegistry {\n if (IORouterRegistry.instance === null) {\n IORouterRegistry.instance = new
IORouterRegistry();\n }\n\n return IORouterRegistry.instance;\n }\n\n /**\n * Register a save-handler router.\n
*\n * @param saveRouter A function that maps a URL-like string onto an instance\n * of `IOHandler` with the
`save` method defined or `null`.\n *\n static registerSaveRouter(saveRouter:
IORouter) {\n IORouterRegistry.getInstance().saveRouters.push(saveRouter);\n }\n\n /**\n * Register a load-
handler router.\n *\n * @param loadRouter A function that maps a URL-like string onto an instance\n * of
`IOHandler` with the `load` method defined or `null`.\n *\n static registerLoadRouter(loadRouter: IORouter) {\n

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IORouterRegistry.getInstance().loadRouters.push(loadRouter);\n }\n\n /**\n * Look up IOHandler for saving,
given a URL-like string.\n *\n * @param url\n * @returns If only one match is found, an instance of IOHandler
with the\n * `save` method defined. If no match is found, `null`.\n * @throws Error, if more than one match is
found.\n */\n static getSaveHandlers(url: string|string[]): IOHandler[] {\n return
IORouterRegistry.getHandlers(url, 'save');\n }\n\n /**\n * Look up IOHandler for loading, given a URL-like
string.\n *\n * @param url\n * @param loadOptions Optional, custom load options.\n *
@returns All valid handlers for `url`, given the currently registered\n * handler routers.\n */\n static
getLoadHandlers(url: string|string[], loadOptions?: LoadOptions):\n IOHandler[] {\n return
IORouterRegistry.getHandlers(url, 'load', loadOptions);\n }\n\n private static getHandlers(\n url: string|string[],
handlerType: 'save'|'load',\n loadOptions?: LoadOptions): IOHandler[] {\n const validHandlers: IOHandler[] =
[];\n const routers = handlerType === 'load' ?\n IORouterRegistry.getInstance().loadRouters :\n
IORouterRegistry.getInstance().saveRouters;\n routers.forEach(router => {\n const handler = router(url,
loadOptions);\n if (handler !== null) {\n validHandlers.push(handler);\n }\n });\n return
validHandlers;\n }\n}\n\nexport const registerSaveRouter = (loadRouter: IORouter) =>\n
IORouterRegistry.registerSaveRouter(loadRouter);\nexport const registerLoadRouter = (loadRouter: IORouter)
=>\n IORouterRegistry.registerLoadRouter(loadRouter);\n\nexport
const getSaveHandlers = (url: string|string[]) =>\n IORouterRegistry.getSaveHandlers(url);\nexport const
getLoadHandlers =\n (url: string|string[], loadOptions?: LoadOptions) =>\n
IORouterRegistry.getLoadHandlers(url, loadOptions);\n", "/*\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport './flags';\nimport { env } from './environment';\nimport { getModelArtifactsInfoForJSON } from
'./io_utils';\nimport { IORouter, IORouterRegistry } from './router_registry';\nimport { IOHandler, ModelArtifacts,
ModelArtifactsInfo, ModelStoreManager, SaveResult } from './types';\n\nconst DATABASE_NAME =
'tensorflowjs';\nconst DATABASE_VERSION = 1;\n\n// Model data and ModelArtifactsInfo (metadata) are stored
in two separate\n// stores for efficient access of the list of stored models and their metadata.\n// 1. The object store
for model data: topology, weights and weight manifests.\nconst MODEL_STORE_NAME = 'models_store';\n// 2.
The object store for ModelArtifactsInfo, including meta-information such\n// as the type of topology (JSON vs
binary), byte size of the topology, byte\n// size of the weights, etc.\nconst INFO_STORE_NAME =
'model_info_store';\n\n/**\n * Delete the entire database for tensorflow.js, including the models store.\n */\n\nexport
async
function deleteDatabase(): Promise<void> {\n const idbFactory = getIndexedDBFactory();\n return new
Promise<void>((resolve, reject) => {\n const deleteRequest =
idbFactory.deleteDatabase(DATABASE_NAME);\n deleteRequest.onsuccess = () => resolve();\n
deleteRequest.onerror = error => reject(error);\n });\n }\n\nfunction getIndexedDBFactory(): IDBFactory {\n
if (!env().getBool('IS_BROWSER')) {\n // TODO(cais): Add more info about what IOHandler subtypes are
available.\n // Maybe point to a doc page on the web and/or automatically determine\n // the available
IOHandlers and print them in the error message.\n throw new Error(\n 'Failed to obtain IndexedDB factory
because the current environment' +\n ' is not a web browser.');

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```

IDBRequest) {\n  const db = openRequest.result as IDBDatabase;\n  db.createObjectStore(MODEL_STORE_NAME, {keyPath: 'modelPath'});\n  db.createObjectStore(INFO_STORE_NAME, {keyPath: 'modelPath'});\n\n  /**\n   * IOHandler subclass: BrowserIndexedDB.\n   * See the doc string of `browserIndexedDB` for more details.\n   */\n  export class BrowserIndexedDB implements IOHandler {\n    protected readonly indexedDB: IDBFactory;\n    protected readonly modelPath: string;\n\n    static readonly URL_SCHEME = 'indexeddb://';\n\n    constructor(modelPath: string) {\n      this.indexedDB = getIndexedDBFactory();\n      if (modelPath == null || !modelPath) {\n        throw new Error(\n          'For IndexedDB, modelPath must not be null, undefined or empty.);\n      }\n      this.modelPath = modelPath;\n    }\n\n    async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n      // TODO(cais): Support saving GraphDef models.\n      if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n        throw new Error(\n          'BrowserLocalStorage.save() does not support saving model topology ' +\n          'in binary formats yet.);\n      }\n      return this.databaseAction(this.modelPath, modelArtifacts) as\n        Promise<SaveResult>;\n    }\n\n    async load(): Promise<ModelArtifacts> {\n      return this.databaseAction(this.modelPath) as\n        Promise<ModelArtifacts>;\n    }\n\n    /**\n     * Perform database action to put model artifacts into or read model artifacts\n     * from IndexedDB object store.\n     * Whether the action is put or get depends on whether `modelArtifacts`\n     * is specified. If it is specified, the action will be put; otherwise the\n     * action will be get.\n     * @param modelPath A unique string path for the model.\n     * @param modelArtifacts If specified, it will be the model artifacts to be\n     * stored in IndexedDB.\n     * @returns A `Promise` of `SaveResult`, if the action is put, or a `Promise`\n     * of `ModelArtifacts`, if the action is get.\n     */\n    private databaseAction(modelPath: string, modelArtifacts?: ModelArtifacts):\n      Promise<ModelArtifacts|SaveResult> {\n      return new Promise<ModelArtifacts|SaveResult>((resolve, reject) => {\n        const openRequest = this.indexedDB.open(DATABASE_NAME, DATABASE_VERSION);\n        openRequest.onupgradeneeded = () => setUpDatabase(openRequest);\n        openRequest.onsuccess = () => {\n          const db = openRequest.result;\n          if (modelArtifacts == null) {\n            // Read model out from object store.\n            const modelTx = db.transaction(MODEL_STORE_NAME, 'readonly');\n            const modelStore = modelTx.objectStore(MODEL_STORE_NAME);\n            const getRequest = modelStore.get(this.modelPath);\n            getRequest.onsuccess = () => {\n              if (getRequest.result == null) {\n                db.close();\n                return reject(new Error(\n                  `Cannot find model with path '${this.modelPath}'\n                  ` in IndexedDB.));\n              } else {\n                resolve(getRequest.result.modelArtifacts);\n              }\n            }; \n            getRequest.onerror = error => {\n              db.close();\n              return reject(getRequest.error);\n            }; \n            modelTx.oncomplete = () => db.close();\n          } else {\n            // Put model into object store.\n            const modelArtifactsInfo: ModelArtifactsInfo =\n              getModelArtifactsInfoForJSON(modelArtifacts);\n            // First, put ModelArtifactsInfo into info store.\n            const infoTx = db.transaction(INFO_STORE_NAME, 'readwrite');\n            let infoStore = infoTx.objectStore(INFO_STORE_NAME);\n            const putInfoRequest = infoStore.put({modelPath: this.modelPath,\n              modelArtifactsInfo});\n            let modelTx: IDBTransaction;\n            putInfoRequest.onsuccess = () => {\n              // Second, put model data into model store.\n              modelTx = db.transaction(MODEL_STORE_NAME, 'readwrite');\n              const modelStore = modelTx.objectStore(MODEL_STORE_NAME);\n              const putModelRequest = modelStore.put({\n                modelPath: this.modelPath,\n                modelArtifacts,\n                modelArtifactsInfo\n              });\n              putModelRequest.onsuccess = () => resolve({modelArtifactsInfo});\n              putModelRequest.onerror = error => {\n                // If the put-model request fails, roll back the info entry as\n                // well.\n                infoStore = infoTx.objectStore(INFO_STORE_NAME);\n                const deleteInfoRequest = infoStore.delete(this.modelPath);\n                deleteInfoRequest.onsuccess = () => {\n                  db.close();\n                  return reject(putModelRequest.error);\n                }; \n                deleteInfoRequest.onerror = error => {\n                  db.close();\n                  return reject(putModelRequest.error);\n                }; \n              }\n            }; \n            putInfoRequest.onerror = error => {\n              db.close();\n              return reject(putInfoRequest.error);\n            }; \n            infoTx.oncomplete = () => {\n              if (modelTx == null) {\n                db.close();\n              } else {\n
```



```

reject(getInfoRequest.error);\n        };\n        // Proceed with deleting model data regardless of whether
deletion\n        // of info data succeeds or not.\n        deleteInfoRequest.onsuccess = deleteModelData;\n
deleteInfoRequest.onerror = error => {\n        deleteModelData();\n        db.close();\n        return
reject(getInfoRequest.error);\n        };\n        }\n        };\n        getInfoRequest.onerror = error => {\n
db.close();\n        return reject(getInfoRequest.error);\n        };\n        infoTx.oncomplete = () => {\n        if
(modelTx == null) {\n
        db.close();\n        } else {\n        modelTx.oncomplete = () => db.close();\n        }\n        };\n        }\n
openRequest.onerror = error => reject(openRequest.error);\n    });\n    }\n    },"/*\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport './flags';\nimport {env} from './environment';\n\nimport
{assert} from './util';\nimport {arrayBufferToBase64String, base64StringToArrayBuffer,
getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from
'/router_registry';\nimport {IOHandler, ModelArtifacts, ModelArtifactsInfo, ModelStoreManager, SaveResult}
from './types';\n\nconst PATH_SEPARATOR = '/';\nconst PATH_PREFIX = 'tensorflowjs_models';\nconst
INFO_SUFFIX = 'info';\nconst MODEL_TOPOLOGY_SUFFIX = 'model_topology';\nconst
WEIGHT_SPECS_SUFFIX = 'weight_specs';\nconst WEIGHT_DATA_SUFFIX = 'weight_data';\nconst
MODEL_METADATA_SUFFIX = 'model_metadata';\n\n/**\n * Purge all tensorflow.js-saved model artifacts from
local storage.\n * @returns Paths of the models purged.\n */\nexport function purgeLocalStorageArtifacts():
string[] {\n    if (!env().getBool('IS_BROWSER') || typeof window === 'undefined' ||\n        typeof
window.localStorage === 'undefined') {\n        throw new Error(\n            'purgeLocalStorageModels() cannot proceed
because local storage is
            '\n            'unavailable in the current environment.);\n    }\n    const LS = window.localStorage;\n    const
purgedModelPaths: string[] = [];\n    for (let i = 0; i < LS.length; ++i) {\n        const key = LS.key(i);\n        const prefix =
PATH_PREFIX + PATH_SEPARATOR;\n        if (key.startsWith(prefix) && key.length > prefix.length) {\n
LS.removeItem(key);\n        const modelName = getModelPathFromKey(key);\n        if
(purgedModelPaths.indexOf(modelName) === -1) {\n            purgedModelPaths.push(modelName);\n        }\n    }\n    return purgedModelPaths;\n}\n\nfunction getModelKeys(path: string): {\n    info: string,\n    topology: string,\n    weightSpecs: string,\n    weightData: string,\n    modelMetadata: string\n} {\n    return {\n        info: [PATH_PREFIX,
path, INFO_SUFFIX].join(PATH_SEPARATOR),\n        topology: [PATH_PREFIX, path,
MODEL_TOPOLOGY_SUFFIX].join(PATH_SEPARATOR),\n        weightSpecs: [PATH_PREFIX, path,
WEIGHT_SPECS_SUFFIX].join(PATH_SEPARATOR),\n        weightData: [PATH_PREFIX, path,
WEIGHT_DATA_SUFFIX].join(PATH_SEPARATOR),\n        modelMetadata: [PATH_PREFIX, path, MODEL_METADATA_SUFFIX].join(PATH_SEPARATOR)\n    };\n}\n\n/**\n * Get model path from a local-storage key.\n * E.g., 'tensorflowjs_models/my/model/1/info' -->
'my/model/1'\n * @param key\n */\nfunction getModelPathFromKey(key: string) {\n    const items =
key.split(PATH_SEPARATOR);\n    if (items.length < 3) {\n        throw new Error('Invalid key format: ${key}');\n    }\n    return items.slice(1, items.length - 1).join(PATH_SEPARATOR);\n}\n\nfunction maybeStripScheme(key: string)
{\n    return key.startsWith(BrowserLocalStorage.URL_SCHEME) ?\n        key.slice(BrowserLocalStorage.URL_SCHEME.length) :\n        key;\n}\n\ndeclare type LocalStorageKeys = {\n    info: string,\n    topology: string,\n    weightSpecs: string,\n    weightData: string,\n    modelMetadata: string\n};\n\n/**\n * IOHandler subclass: Browser Local Storage.\n * See the doc string to `browserLocalStorage` for more
details.\n */\nexport class BrowserLocalStorage

```

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implements IOHandler {\n  protected readonly LS: Storage;\n  protected readonly modelPath: string;\n  protected
readonly keys: LocalStorageKeys;\n\n  static readonly URL_SCHEME = 'localStorage://';\n\n
constructor(modelPath: string) {\n  if (!env().getBool('IS_BROWSER') || typeof window === 'undefined' ||\n
typeof window.localStorage === 'undefined') {\n    // TODO(cais): Add more info about what IOHandler subtypes
are\n    // available.\n    // Maybe point to a doc page on the web and/or automatically determine\n    // the
available IOHandlers and print them in the error message.\n    throw new Error(\n      'The current environment
does not support local storage.);\n  }\n  this.LS = window.localStorage;\n\n  if (modelPath === null || !modelPath)
{\n    throw new Error(\n      'For local storage, modelPath must not be null, undefined or empty.);\n  }\n
this.modelPath = modelPath;\n  this.keys = getModelKeys(this.modelPath);\n  }\n\n
/**\n * Save model artifacts to browser local storage.\n * See the documentation to `browserLocalStorage`
for details on the saved\n * artifacts.\n * @param modelArtifacts The model artifacts to be stored.\n *
@return An instance of SaveResult.\n */\n async save(modelArtifacts: ModelArtifacts): Promise<SaveResult>
{\n  if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n    throw new Error(\n
'BrowserLocalStorage.save() does not support saving model topology ' +\n      'in binary formats yet.);\n  } else
{\n    const topology = JSON.stringify(modelArtifacts.modelTopology);\n    const weightSpecs =
JSON.stringify(modelArtifacts.weightSpecs);\n\n    const modelArtifactsInfo: ModelArtifactsInfo =\n
getModelArtifactsInfoForJSON(modelArtifacts);\n\n    try {\n      this.LS.setItem(this.keys.info,
JSON.stringify(modelArtifactsInfo));\n      this.LS.setItem(this.keys.topology, topology);\n
this.LS.setItem(this.keys.weightSpecs,\n        weightSpecs);\n      this.LS.setItem(\n        this.keys.weightData,\n
arrayBufferToBase64String(modelArtifacts.weightData));\n      const result: ModelArtifacts = {\n        format:
modelArtifacts.format,\n        generatedBy: modelArtifacts.generatedBy,\n        convertedBy:
modelArtifacts.convertedBy\n      };\n      if (modelArtifacts.signature != null) {\n        result.signature =
modelArtifacts.signature;\n      }\n      if (modelArtifacts.userDefinedMetadata != null) {\n
result.userDefinedMetadata = modelArtifacts.userDefinedMetadata;\n      }\n      if
(modelArtifacts.modelInitializer != null) {\n        result.modelInitializer = modelArtifacts.modelInitializer;\n
      }\n      this.LS.setItem(this.keys.modelMetadata, JSON.stringify(result));\n      return {modelArtifactsInfo};\n
    } catch (err) {\n      // If saving failed, clean up all items saved so far.\n      this.LS.removeItem(this.keys.info);\n
      this.LS.removeItem(this.keys.topology);\n      this.LS.removeItem(this.keys.weightSpecs);\n
this.LS.removeItem(this.keys.weightData);\n      this.LS.removeItem(this.keys.modelMetadata);\n      throw new
Error(\n        `Failed to save model '${this.modelPath}' to local storage: ` +\n        `size quota being exceeded is
a possible cause of this failure: ` +\n        `modelTopologyBytes=${modelArtifactsInfo.modelTopologyBytes}, `
+\n        `weightSpecsBytes=${modelArtifactsInfo.weightSpecsBytes}, ` +\n
        `weightDataBytes=${modelArtifactsInfo.weightDataBytes}.`);\n    }\n  }\n}\n\n /**\n * Load a model from
local storage.\n * See the documentation to `browserLocalStorage` for details on the saved\n * artifacts.\n
*\n * @returns The loaded model (if loading succeeds).\n */\n async load(): Promise<ModelArtifacts> {\n
const info =\n  JSON.parse(this.LS.getItem(this.keys.info)) as ModelArtifactsInfo;\n
  if (info == null) {\n    throw new Error(\n      `In local storage, there is no model with name
'${this.modelPath}'`);\n  }\n  if (info.modelTopologyType !== 'JSON') {\n    throw new Error(\n
'BrowserLocalStorage does not support loading non-JSON model ' +\n      'topology yet.);\n  }\n  const out:
ModelArtifacts = {};\n  // Load topology.\n  const topology =
JSON.parse(this.LS.getItem(this.keys.topology));\n  if (topology == null) {\n    throw new Error(\n      `In local
storage, the topology of model '${this.modelPath}' ` +\n      `is missing.);\n  }\n  out.modelTopology =
topology;\n  // Load weight specs.\n  const weightSpecs =
JSON.parse(this.LS.getItem(this.keys.weightSpecs));\n  if (weightSpecs == null) {\n    throw new Error(\n
`In local storage, the weight specs of model '${this.modelPath}' ` +\n      `are missing.);\n  }\n
out.weightSpecs = weightSpecs;\n\n  // Load meta-data fields.\n

```

```

const metadataString = this.LS.getItem(this.keys.modelMetadata);\n  if (metadataString != null) {\n    const\n    metadata = JSON.parse(metadataString) as ModelArtifacts;\n    out.format = metadata['format'];\n    out.generatedBy = metadata['generatedBy'];\n    out.convertedBy = metadata['convertedBy'];\n    if\n    (metadata['signature'] != null) {\n      out.signature = metadata['signature'];\n    }\n    if\n    (metadata['userDefinedMetadata'] != null) {\n      out.userDefinedMetadata = metadata['userDefinedMetadata'];\n    }\n    if (metadata['modelInitializer'] != null) {\n      out.modelInitializer = metadata['modelInitializer'];\n    }\n  }\n  // Load weight data.\n  const weightDataBase64 = this.LS.getItem(this.keys.weightData);\n  if\n  (weightDataBase64 == null) {\n    throw new Error(\n      `In local storage, the binary weight values of model`\n      +`\n      `${this.modelPath}` are missing.`);\n  }\n  out.weightData =\n  base64StringToArrayBuffer(weightDataBase64);\n\n  return out;\n }\n}\n\nexport const localStorageRouter: IORouter = (url: string|string[]) => {\n  if\n  (!env().getBool('IS_BROWSER')) {\n    return null;\n  } else {\n    if (!Array.isArray(url) &&\n    url.startsWith(BrowserLocalStorage.URL_SCHEME)) {\n      return browserLocalStorage(\n      url.slice(BrowserLocalStorage.URL_SCHEME.length));\n    } else {\n      return null;\n    }\n  }\n}\n\nIORouterRegistry.registerSaveRouter(localStorageRouter);\nIORouterRegistry.registerLoadRouter(localStorageRouter);\n\n/**\n * Factory function for local storage IOHandler.\n * This `IOHandler` supports both `save`\n * and `load`.\n * For each model's saved artifacts, four items are saved to local storage.\n * -\n * `${PATH_SEPARATOR}/${modelPath}/info`: Contains meta-info about the\n * model, such as date saved, type\n * of the topology, size in bytes, etc.\n * - `${PATH_SEPARATOR}/${modelPath}/topology`: Model topology. For\n * Keras-\n * style models, this is a\n * stringized JSON.\n * - `${PATH_SEPARATOR}/${modelPath}/weight_specs`: Weight specs of the\n * model,\n * can be used to decode the saved binary weight values (see\n * item below).\n * -\n * `${PATH_SEPARATOR}/${modelPath}/weight_data`: Concatenated binary\n * weight values, stored as a\n * base64-encoded string.\n * Saving may throw an `Error` if the total size of the artifacts exceed the\n * browser-\n * specific quota.\n * @param modelPath A unique identifier for the model to be saved. Must be a\n * non-empty\n * string.\n * @returns An instance of `IOHandler`, which can be used with, e.g.,\n * `tf.Model.save`.\n */\nexport\nfunction browserLocalStorage(modelPath: string): IOHandler {\n  return new\n  BrowserLocalStorage(modelPath);\n}\n\nexport class BrowserLocalStorageManager implements\nModelStoreManager {\n  private readonly LS: Storage;\n\n  constructor() {\n    assert(\n    env().getBool('IS_BROWSER'),\n    () => 'Current environment is not a web browser');\n    assert(\n    typeof window === 'undefined' ||\n    typeof window.localStorage !== 'undefined',\n    () => 'Current\n    browser does not appear to support localStorage');\n    this.LS = window.localStorage;\n  }\n\n  async listModels():\n  Promise<{[path: string]: ModelArtifactsInfo}> {\n    const out: {[path: string]: ModelArtifactsInfo} = {};\n    const\n    prefix = PATH_PREFIX + PATH_SEPARATOR;\n    const suffix = PATH_SEPARATOR + INFO_SUFFIX;\n    for (let i = 0; i < this.LS.length; ++i) {\n      const key = this.LS.key(i);\n      if (key.startsWith(prefix) &&\n      key.endsWith(suffix)) {\n        const modelPath = getModelPathFromKey(key);\n        out[modelPath] =\n        JSON.parse(this.LS.getItem(key)) as ModelArtifactsInfo;\n      }\n    }\n    return out;\n  }\n\n  async\n  removeModel(path: string): Promise<ModelArtifactsInfo> {\n    path = maybeStripScheme(path);\n    const keys =\n    getModelKeys(path);\n    if (this.LS.getItem(keys.info) == null) {\n      throw new Error(`Cannot find model at\n      path '${path}'`);\n    }\n    const info = JSON.parse(this.LS.getItem(keys.info)) as ModelArtifactsInfo;\n    this.LS.removeItem(keys.info);\n    this.LS.removeItem(keys.topology);\n    this.LS.removeItem(keys.weightSpecs);\n    this.LS.removeItem(keys.weightData);\n    return info;\n  }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */

```



```

=====
*/
 * Classes and functions for model management across multiple storage mediums.
 * Supported
client actions:
 * - Listing models on all registered storage mediums.
 * - Remove model by URL from any
registered storage mediums, by using URL
 * string.
 * - Moving or copying model from one path to another in
the same medium or from
 * one medium to another, by using URL strings.
*/
import {assert} from
'./util';
import {IORouterRegistry} from './router_registry';
import {ModelArtifactsInfo, ModelStoreManager}
from './types';
const URL_SCHEME_SUFFIX = '://';
export class ModelStoreManagerRegistry {
 //
Singleton instance.
 private static instance: ModelStoreManagerRegistry;

 private managers: {[scheme: string]:
ModelStoreManager};

 private constructor() {
 this.managers = {};
 }

 private static getInstance():
ModelStoreManagerRegistry {
 if (ModelStoreManagerRegistry.instance == null) {
ModelStoreManagerRegistry.instance
 = new ModelStoreManagerRegistry();
 }
 return ModelStoreManagerRegistry.instance;
 }
}

/**
 *
Register a save-handler router.
 * @param saveRouter A function that maps a URL-like string onto an
instance
 * of `IOHandler` with the `save` method defined or `null`.
*/
static registerManager(scheme:
string, manager: ModelStoreManager) {
 assert(scheme != null, () => 'scheme must not be undefined or null.');
```

```

if (scheme.endsWith(URL_SCHEME_SUFFIX)) {
 scheme = scheme.slice(0,
scheme.indexOf(URL_SCHEME_SUFFIX));
}
 assert(scheme.length > 0, () => 'scheme must not be an
empty string.');
```

```

const registry = ModelStoreManagerRegistry.getInstance();
 assert(
registry.managers[scheme] == null,
 () => `A model store manager is already registered for scheme '${
scheme}'.`);
 registry.managers[scheme] = manager;
}

static getManager(scheme: string):
ModelStoreManager {
const manager = this.getInstance().managers[scheme];
 if (manager == null) {
 throw new Error(`Cannot
find model manager for scheme '${scheme}'`);
 }
 return manager;
}

static getSchemes(): string[] {
return Object.keys(this.getInstance().managers);
}
}

/**
 *
Helper method for parsing a URL string into a
scheme and a path.
 * @param url E.g., 'localStorage://my-model'
 * @returns A dictionary with two fields:
scheme and path.
 * Scheme: e.g., 'localStorage' in the example above.
 * Path: e.g., 'my-model' in the example
above.
*/
function parseURL(url: string): {scheme: string, path: string} {
 if
(url.indexOf(URL_SCHEME_SUFFIX) === -1) {
 throw new Error(`
The url string provided does not
contain a scheme.
` +
`Supported schemes are:
` +
`${ModelStoreManagerRegistry.getSchemes().join(',')}`);
 }
 return {
scheme:
url.split(URL_SCHEME_SUFFIX)[0],
path: url.split(URL_SCHEME_SUFFIX)[1],
};
}

async function cloneModelInternal(
sourceURL: string, destURL: string,
deleteSource = false):
Promise<ModelArtifactsInfo> {
 assert(
sourceURL !== destURL,
 () => `Old path and new path are the
same: '${sourceURL}'`);
const loadHandlers = IORouterRegistry.getLoadHandlers(sourceURL);
 assert(
loadHandlers.length > 0,
 () => `Copying failed because no load handler is found for source URL ${
sourceURL}.`);
 assert(
loadHandlers.length < 2,
 () => `Copying failed because more than one
(${loadHandlers.length})
` +
`load handlers for source URL ${sourceURL}.`);
const loadHandler =
loadHandlers[0];
const saveHandlers = IORouterRegistry.getSaveHandlers(destURL);
 assert(
saveHandlers.length > 0,
 () => `Copying failed because no save handler is found for destination ` +
`URL ${destURL}.`);
 assert(
saveHandlers.length < 2,
 () => `Copying failed because
more than one (${loadHandlers.length})
` +
`save handlers for destination URL ${destURL}.`);
const
saveHandler = saveHandlers[0];
const sourceScheme = parseURL(sourceURL).scheme;
const sourcePath =
parseURL(sourceURL).path;
const sameMedium = sourceScheme === parseURL(sourceURL).scheme;
const modelArtifacts = await loadHandler.load();
 // If moving within the same storage medium, remove the old
model as soon as
 // the loading is done. Without doing this, it is possible that the combined
 // size of the two
models will cause the cloning to fail.
 if (deleteSource && sameMedium) {
 await
ModelStoreManagerRegistry.getManager(sourceScheme)
.removeModel(sourcePath);
 }
const
saveResult = await saveHandler.save(modelArtifacts);
 // If moving between mediums, the deletion is done after

```

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the save succeeds.\n // This guards against the case in which saving to the destination medium\n // fails.\n if
(deleteSource && !sameMedium)
  {\n   await ModelStoreManagerRegistry.getManager(sourceScheme)\n     .removeModel(sourcePath);\n  }\n\n  return saveResult.modelArtifactsInfo;\n}\n\n/**\n * List all models stored in registered storage mediums.\n *\n * For a web browser environment, the registered mediums are Local Storage and\n * IndexedDB.\n *\n * First create and save a model.\n *\n * const model = tf.sequential();\n * model.add(tf.layers.dense({units: 1,
inputShape: [10], activation: 'sigmoid'}));\n * await model.save('localstorage://demo/management/model1');\n *\n * // Then list existing models.\n * console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Delete the model.\n * await tf.io.removeModel('localstorage://demo/management/model1');\n *\n * // List models again.\n * console.log(JSON.stringify(await tf.io.listModels()));\n *\n * @returns A `Promise` of a dictionary mapping
URLs of existing models to\n * their model artifacts info. URLs include medium-specific schemes,
e.g.,\n * 'indexeddb://my/model/1'. Model artifacts info include type of the\n * model's topology, byte sizes of the
topology, weights, etc.\n *\n * @doc {\n *   heading: 'Models',\n *   subheading: 'Management',\n *   namespace:
'io',\n *   ignoreCI: true\n * }\n *\n * ^\nasync function listModels(): Promise<{[url: string]: ModelArtifactsInfo}> {\n
const schemes = ModelStoreManagerRegistry.getSchemes();\n const out: {[url: string]: ModelArtifactsInfo} =
{};\n for (const scheme of schemes) {\n   const schemeOut =\n     await
ModelStoreManagerRegistry.getManager(scheme).listModels();\n   for (const path in schemeOut) {\n     const url =
scheme + URL_SCHEME_SUFFIX + path;\n     out[url] = schemeOut[path];\n   }\n }\n return out;\n}\n\n/**\n *
Remove a model specified by URL from a registered storage medium.\n *\n * First create and save a
model.\n *\n * const model = tf.sequential();\n * model.add(tf.layers.dense({units: 1, inputShape: [10],
activation: 'sigmoid'}));\n
* await model.save('localstorage://demo/management/model1');\n *\n * // Then list existing models.\n *
console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Delete the model.\n * await
tf.io.removeModel('localstorage://demo/management/model1');\n *\n * // List models again.\n *
console.log(JSON.stringify(await tf.io.listModels()));\n *\n * @param url A URL to a stored model, with a
scheme prefix, e.g.,\n * 'localstorage://my-model-1', 'indexeddb://my/model/2'.\n *\n * @returns ModelArtifactsInfo of
the deleted model (if and only if deletion\n * is successful).\n *\n * @throws Error if deletion fails, e.g., if no model
exists at `path`.\n *\n * @doc {\n *   heading: 'Models',\n *   subheading: 'Management',\n *   namespace: 'io',\n *
ignoreCI: true\n * }\n *\n * ^\nasync function removeModel(url: string): Promise<ModelArtifactsInfo> {\n const
schemeAndPath = parseURL(url);\n const manager =
ModelStoreManagerRegistry.getManager(schemeAndPath.scheme);\n return
manager.removeModel(schemeAndPath.path);\n}\n\n/**\n * Copy a model from one URL to another.\n *\n * This
function supports:\n *\n * 1. Copying within a storage medium, e.g.,\n *   `tf.io.copyModel('localstorage://model-1',
'localstorage://model-2')`\n *\n * 2. Copying between two storage mediums, e.g.,\n *   `tf.io.copyModel('localstorage://model-1', 'indexeddb://model-1')`\n *\n * First create and save a model.\n
*\n * const model = tf.sequential();\n * model.add(tf.layers.dense({units: 1, inputShape: [10], activation:
'sigmoid'}));\n * await model.save('localstorage://demo/management/model1');\n *\n * // Then list existing
models.\n * console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Copy the model, from Local Storage to
IndexedDB.\n * await tf.io.copyModel(\n *   'localstorage://demo/management/model1',\n *
'indexeddb://demo/management/model1');\n *\n * // List models again.\n * console.log(JSON.stringify(await
tf.io.listModels()));\n *\n * //
Remove both models.\n * await tf.io.removeModel('localstorage://demo/management/model1');\n * await
tf.io.removeModel('indexeddb://demo/management/model1');\n *\n * @param sourceURL Source URL of
copying.\n * @param destURL Destination URL of copying.\n * @returns ModelArtifactsInfo of the copied model
(if and only if copying\n * is successful).\n *\n * @throws Error if copying fails, e.g., if no model exists at
`sourceURL`, or\n * if `oldPath` and `newPath` are identical.\n *\n * @doc {\n *   heading: 'Models',\n *
subheading: 'Management',\n *   namespace: 'io',\n *   ignoreCI: true\n * }\n *\n * ^\nasync function copyModel(\n
sourceURL: string, destURL: string): Promise<ModelArtifactsInfo> {\n const deleteSource = false;\n return

```

```

cloneModelInternal(sourceURL, destURL, deleteSource);\n}\n\n**\n * Move a model from one URL to another.\n
*\n * This function supports:\n *\n * 1. Moving within a storage medium, e.g.,\n *
`tf.io.moveModel('localStorage://model-1', 'localStorage://model-2')`\n
* 2. Moving between two storage mediums, e.g.,\n * `tf.io.moveModel('localStorage://model-1',
'indexeddb://model-1')`\n *\n * ``js\n * // First create and save a model.\n * const model = tf.sequential();\n *
model.add(tf.layers.dense(\n *   {units: 1, inputShape: [10], activation: 'sigmoid'}));\n * await
model.save('localStorage://demo/management/model1');\n *\n * // Then list existing models.\n *
console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Move the model, from Local Storage to
IndexedDB.\n * await tf.io.moveModel(\n *   'localStorage://demo/management/model1',\n *
'indexeddb://demo/management/model1');\n *\n * // List models again.\n * console.log(JSON.stringify(await
tf.io.listModels()));\n *\n * // Remove the moved model.\n * await
tf.io.removeModel('indexeddb://demo/management/model1');\n * ``\n *\n * @param sourceURL Source URL of
moving.\n * @param destURL Destination URL of moving.\n * @returns ModelArtifactsInfo of the copied
model (if and only if copying\n * is successful).\n * @throws Error if moving fails, e.g., if no model exists at
`sourceURL`, or\n * if `oldPath` and `newPath` are identical.\n *\n * @doc {\n *   heading: 'Models',\n *
subheading: 'Management',\n *   namespace: 'io',\n *   ignoreCI: true\n * }\n *\n * ^\n\nasync function moveModel(\n
sourceURL: string, destURL: string): Promise<ModelArtifactsInfo> {\n  const deleteSource = true;\n  return
cloneModelInternal(sourceURL, destURL, deleteSource);\n}\n\nexport {moveModel, copyModel, removeModel,
listModels};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an
\n"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport './flags';\n\nimport {env} from './environment';\n\nimport {BrowserIndexedDB,
BrowserIndexedDBManager} from './io/indexed_db';\n\nimport {BrowserLocalStorage,
BrowserLocalStorageManager} from './io/local_storage';\n\nimport {ModelStoreManagerRegistry} from
'./io/model_management';\n\nimport {Platform} from './platform';\n\nexport class PlatformBrowser implements
Platform {\n  // According to the spec, the built-in encoder can do only UTF-8 encoding.\n  //
https://developer.mozilla.org/en-US/docs/Web/API/TextEncoder/TextEncoder\n  private textEncoder:
TextEncoder;\n\n  fetch(path: string, init?: RequestInit): Promise<Response> {\n    return fetch(path, init);\n  }\n\n
now(): number {\n    return
performance.now();\n  }\n\n  encode(text: string, encoding: string): Uint8Array {\n    if (encoding !== 'utf-8' &&
encoding !== 'utf8') {\n      throw new Error(\n        `Browser's encoder only supports utf-8, but got
${encoding}`);\n    }\n    if (this.textEncoder == null) {\n      this.textEncoder = new TextEncoder();\n    }\n    return
this.textEncoder.encode(text);\n  }\n\n  decode(bytes: Uint8Array, encoding: string): string {\n    return new
TextDecoder(encoding).decode(bytes);\n  }\n}\n\nif (env().get('IS_BROWSER')) {\n  env().setPlatform('browser',
new PlatformBrowser());\n\n  // Register LocalStorage IOHandler\n  try {\n
ModelStoreManagerRegistry.registerManager(\n    BrowserLocalStorage.URL_SCHEME, new
BrowserLocalStorageManager());\n  } catch (err) {\n  }\n\n  // Register IndexedDB IOHandler\n  try {\n
ModelStoreManagerRegistry.registerManager(\n    BrowserIndexedDB.URL_SCHEME, new
BrowserIndexedDBManager());\n  } catch (err) {\n  }\n}\n", "/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\nimport {env} from './environment';\nimport {Platform} from './platform';\n\n// We are wrapping this within an\nobject so it can be stubbed by Jasmine.\nexport const getNodeFetch = {\n // tslint:disable-next-line:no-require-  
imports\n importFetch: () => require('node-fetch')\n};\n\ntype FetchFn  
= (url: string, init?: RequestInit) => Promise<Response>;\n\nlet systemFetch: FetchFn;\n\n// These getters and setters  
are for testing so we don't export a mutable\n// variable.\nexport function resetSystemFetch() {\n systemFetch =  
null;\n}\n\nexport function setSystemFetch(fetchFn: FetchFn) {\n systemFetch = fetchFn;\n}\n\nexport function  
getSystemFetch(): FetchFn {\n return systemFetch;\n}\n\nexport class PlatformNode implements Platform {\n private textEncoder: TextEncoder;\n // tslint:disable-next-line:no-any\n util: any;\n\n constructor() {\n //  
tslint:disable-next-line:no-require-imports\n this.util = require('util');\n // According to the spec, the built-in  
encoder can do only UTF-8 encoding.\n // https://developer.mozilla.org/en-  
US/docs/Web/API/TextEncoder/TextEncoder\n this.textEncoder = new this.util.TextEncoder();\n }\n\n fetch(path: string, requestInits?: RequestInit): Promise<Response> {\n if (env().global.fetch != null) {\n return  
env().global.fetch(path,  
requestInits);\n }\n\n if (systemFetch == null) {\n systemFetch = getNodeFetch.importFetch();\n }\n\n return systemFetch(path, requestInits);\n }\n\n now(): number {\n const time = process.hrtime();\n return  
time[0] * 1000 + time[1] / 1000000;\n }\n\n encode(text: string, encoding: string): Uint8Array {\n if (encoding  
!= 'utf-8' && encoding != 'utf8') {\n throw new Error(\n `Node built-in encoder only supports utf-8, but  
got ${encoding}`);\n }\n return this.textEncoder.encode(text);\n }\n\n decode(bytes: Uint8Array, encoding:  
string): string {\n if (bytes.length === 0) {\n return "";\n }\n return new  
this.util.TextDecoder(encoding).decode(bytes);\n }\n}\n\nif (env().get('IS_NODE')) {\n env().setPlatform('node',  
new PlatformNode());\n}\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed  
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except  
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software  
distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {TensorBuffer} from './tensor';\nimport {DataType, DataTypeMap, Rank, ShapeMap} from  
 './types';\nimport * as util from './util';\n\n/**\n * Creates an empty `tf.TensorBuffer` with the specified `shape` and  
`dtype`.\n *\n * The values are stored in CPU as `TypedArray`. Fill the buffer using  
`buffer.set()`, or by  
modifying directly `buffer.values`.\n *\n * When done, call `buffer.toTensor()` to get an immutable `tf.Tensor`  
with  
\n those values.\n *\n * ```js\n * // Create a buffer and set values at particular indices.\n * const buffer = tf.buffer([2,  
2]);\n * buffer.set(3, 0, 0);\n * buffer.set(5, 1, 0);\n *\n * // Convert the buffer back to a tensor.\n *  
buffer.toTensor().print();\n * ```\n *\n * @param shape An array of integers defining the output tensor shape.\n *\n * @param dtype The dtype of the buffer. Defaults to 'float32'.  
\n * @param values The values of the buffer as  
`TypedArray`. Defaults to\n * zeros.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\n export  
function buffer<R extends Rank, D extends DataType = 'float32'>(\n shape: ShapeMap[R], dtype: D = 'float32' as  
D,\n values?: DataTypeMap[D]): TensorBuffer<R, D> {\n dtype = dtype || 'float32' as D;\n util.assertNonNegativeIntegerDimensions(shape);\n return new TensorBuffer<R, D>(shape, dtype,  
values);\n }\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the  
Apache License, Version 2.0 (the  
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the  
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
```

agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Cast, CastAttrs, CastInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {DataType, TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * Casts a `tf.Tensor` to a new dtype.\n *\n * ```js\n * const x = tf.tensor1d([1.5, 2.5, 3]);\n * tf.cast(x, 'int32').print();\n * ```\n *\n * @param x The input tensor to be casted.\n * @param dtype The dtype to cast the input tensor to.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction cast_<T extends Tensor>(x: T|TensorLike, dtype: DataType): T {\n  const $x = convertToTensor(x, 'x', 'cast');\n  // Sanity checks.\n  if (!util.isValidDtype(dtype)) {\n    throw new Error(`Failed to cast to unknown dtype ${dtype}`);\n  }\n  if (dtype === 'string' && $x.dtype !== 'string' ||\n    dtype !== 'string' && $x.dtype === 'string') {\n    throw new Error('Only strings can be casted to strings');\n  }\n  const inputs: CastInputs = {x: $x};\n  const attrs: CastAttrs = {dtype};\n  return ENGINE.runKernel(\n    Cast, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const cast = op({cast_});\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Identity, IdentityInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Creates a new tensor with the same values and shape as the specified\n * tensor.\n *\n * ```js\n * const x = tf.tensor([1, 2]);\n * x.clone().print();\n * ```\n *\n * @param x The tensor to clone.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction clone_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'clone', 'string_or_numeric');\n  const inputs: IdentityInputs = {x: $x};\n  // Note this op is called tf.identity in python. Hence the kernel name used\n  // here.\n  return ENGINE.runKernel(Identity, inputs as {} as NamedTensorMap);\n}\n\nexport const clone = op({clone_});\n\n",/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Tensor} from './tensor';\n\n/**\n * Prints information about the `tf.Tensor` including its data.\n *\n * ```js\n * const verbose = true;\n * tf.tensor2d([1, 2, 3, 4], [2, 2]).print(verbose);\n * ```\n *\n * @param x The tensor to be printed.\n * @param verbose Whether to print verbose information about the `Tensor`,\n * including dtype and size.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function print<T extends Tensor>(x: T, verbose = false): void {\n  console.log(x.toString(verbose));\n}\n\n",/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
```

by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\n// Required side effectful code for tfjs-core\n// Set up Engine and ENV\nimport {getOrCreateEngine} from\n './engine';\ngetOrCreateEngine();\n\n// Register backend-agnostic flags.\nimport './flags';\n\n// Register\n platforms\nimport './platforms/platform_browser';\nimport './platforms/platform_node';\n\n// Set up\n OpHandler\nimport {buffer} from './ops/buffer';\nimport {cast}\n from './ops/cast';\nimport {clone} from './ops/clone';\nimport {print} from './ops/print';\nimport {OpHandler,\n setOpHandler} from './tensor';\nconst opHandler: OpHandler = {\n buffer,\n cast,\n clone,\n print\n};\nsetOpHandler(opHandler);\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n */\n\n=====\n\n
```

```
*/\n\n/**\n * IOHandlers related\n\n to files, such as browser-triggered file downloads,\n * user-selected files in browser.\n */\nimport\n './flags';\nimport {env} from './environment';\nimport {basename, concatenateArrayBuffers,\n getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from\n './router_registry';\nimport {IOHandler, ModelArtifacts, ModelJSON, SaveResult, WeightsManifestConfig,\n WeightsManifestEntry} from './types';\n\nconst DEFAULT_FILE_NAME_PREFIX = 'model';\nconst\n DEFAULT_JSON_EXTENSION_NAME = '.json';\nconst\n DEFAULT_WEIGHT_DATA_EXTENSION_NAME =\n '.weights.bin';\n\nfunction defer<T>(f: () => T): Promise<T> {\n return new Promise(resolve =>\n setTimeout(resolve)).then(f);\n}\n\nexport class BrowserDownloads implements IOHandler {\n private readonly\n modelTopologyFileName: string;\n private readonly\n weightDataFileName: string;\n private readonly\n jsonAnchor: HTMLAnchorElement;\n private readonly\n weightDataAnchor: HTMLAnchorElement;\n\n static readonly\n URL_SCHEME = 'downloads://';\n\n constructor(fileNamePrefix?: string) {\n if (!env().getBool('IS_BROWSER')) {\n // TODO(cais): Provide info\n on what IOHandlers are available under the\n // current environment.\n throw new Error(\n 'browserDownloads() cannot proceed because the current environment '\n +\n 'is not a browser.);\n }\n\n if\n (fileNamePrefix.startsWith(BrowserDownloads.URL_SCHEME)) {\n fileNamePrefix =\n fileNamePrefix.slice(BrowserDownloads.URL_SCHEME.length);\n }\n\n if (fileNamePrefix == null ||\n fileNamePrefix.length === 0) {\n fileNamePrefix = DEFAULT_FILE_NAME_PREFIX;\n }\n\n this.modelTopologyFileName = fileNamePrefix + DEFAULT_JSON_EXTENSION_NAME;\n this.weightDataFileName =\n fileNamePrefix + DEFAULT_WEIGHT_DATA_EXTENSION_NAME;\n }\n\n async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n if (typeof (document) === 'undefined') {\n throw new Error(\n 'Browser downloads are not supported in\n '\n +\n 'this environment since `document` is not present');\n }\n\n const weightsURL =\n window.URL.createObjectURL(new Blob([\n [modelArtifacts.weightData], {type: 'application/octet-\n stream'}]));\n\n if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n throw new Error(\n 'BrowserDownloads.save() does not support saving model topology '\n +\n 'in binary formats yet.);\n }\n\n else {\n const weightsManifest: WeightsManifestConfig = [{\n paths: ['./' + this.weightDataFileName],\n weights:\n modelArtifacts.weightSpecs\n }];\n const modelTopologyAndWeightManifest: ModelJSON = {\n modelTopology: modelArtifacts.modelTopology,\n format: modelArtifacts.format,\n generatedBy:\n modelArtifacts.generatedBy,\n convertedBy: modelArtifacts.convertedBy,\n weightsManifest\n };\n\n }\n\n }\n\n }\n\n
```

```

if (modelArtifacts.signature != null) {\n    modelTopologyAndWeightManifest.signature =
modelArtifacts.signature;\n
    }\n    if (modelArtifacts.userDefinedMetadata != null) {\n
modelTopologyAndWeightManifest.userDefinedMetadata =\n        modelArtifacts.userDefinedMetadata;\n    }\n    if (modelArtifacts.modelInitializer != null) {\n    modelTopologyAndWeightManifest.modelInitializer =\nmodelArtifacts.modelInitializer;\n    }\n    const modelTopologyAndWeightManifestURL =\nwindow.URL.createObjectURL(new Blob(\n    [JSON.stringify(modelTopologyAndWeightManifest)],\n    {type: 'application/json'}));\n    // If anchor elements are not provided, create them without attaching them\n// to parents, so that the downloaded file names can be controlled.\n    const jsonAnchor = this.jsonAnchor == null
? document.createElement('a') :\n        this.jsonAnchor;\n    jsonAnchor.download =
this.modelTopologyFileName;\n    jsonAnchor.href = modelTopologyAndWeightManifestURL;\n
    // Trigger downloads by evoking a click event on the download anchors.\n    // When multiple downloads are
started synchronously, Firefox will only\n    // save the last one.\n    await defer(() =>
jsonAnchor.dispatchEvent(new MouseEvent('click')));\n    if (modelArtifacts.weightData != null) {\n    const
weightDataAnchor = this.weightDataAnchor == null ?\n        document.createElement('a') :\nthis.weightDataAnchor;\n    weightDataAnchor.download = this.weightDataFileName;\n
weightDataAnchor.href = weightsURL;\n    await defer(\n        () => weightDataAnchor.dispatchEvent(new
MouseEvent('click')));\n    }\n    return {modelArtifactsInfo:
getModelArtifactsInfoForJSON(modelArtifacts)};\n    }\n}\n\nclass BrowserFiles implements IOHandler {\n
private readonly files: File[];\n    constructor(files: File[]) {\n    if (files == null || files.length < 1) {\n    throw new
Error(\n        `When calling browserFiles, at least
1 file is required,`\n        `but received ${files}`);\n    }\n    this.files = files;\n    }\n    async load():
Promise<ModelArtifacts> {\n    const jsonFile = this.files[0];\n    const weightFiles = this.files.slice(1);\n    return
new Promise<ModelArtifacts>((resolve, reject) => {\n    const jsonReader = new FileReader();\n
jsonReader.onload = (event: Event) => {\n    // tslint:disable-next-line:no-any\n    const modelJSON =
JSON.parse((event.target as any).result) as ModelJSON;\n    const modelTopology =
modelJSON.modelTopology;\n    if (modelTopology == null) {\n    reject(new Error(\n
`modelTopology field is missing from file ${jsonFile.name}`));\n    return;\n    }\n    if
(weightFiles.length === 0) {\n    resolve({modelTopology});\n    }\n    const weightsManifest =
modelJSON.weightsManifest;\n    if (weightsManifest == null) {\n    reject(new Error(\n
`weightManifest field
is missing from file ${jsonFile.name}`));\n    return;\n    }\n    let pathToFile: {[path: string]: File};\n
try {\n    pathToFile =\n        this.checkManifestAndWeightFiles(weightsManifest, weightFiles);\n    }
catch (err) {\n    reject(err);\n    return;\n    }\n    const weightSpecs: WeightManifestEntry[] = [];\n
const paths: string[] = [];\n    const perFileBuffers: ArrayBuffer[] = [];\n
weightsManifest.forEach(weightsGroup => {\n    weightsGroup.paths.forEach(path => {\n
paths.push(path);\n    perFileBuffers.push(null);\n    });\n
weightSpecs.push(...weightsGroup.weights);\n    });\n    weightsManifest.forEach(weightsGroup => {\n
weightsGroup.paths.forEach(path => {\n    const weightFileReader = new FileReader();\n
weightFileReader.onload = (event: Event) => {\n    // tslint:disable-next-line:no-any\n
const weightData = (event.target as any).result as ArrayBuffer;\n    const index = paths.indexOf(path);\n
perFileBuffers[index] = weightData;\n    if (perFileBuffers.indexOf(null) === -1) {\n    const result:
ModelArtifacts = {\n        modelTopology,\n        weightSpecs,\n        weightData:
concatenateArrayBuffers(perFileBuffers),\n        format: modelJSON.format,\n        generatedBy:
modelJSON.generatedBy,\n        convertedBy: modelJSON.convertedBy\n    };\n    if
(modelJSON.signature != null) {\n        result.signature = modelJSON.signature;\n    }\n    if
(modelJSON.userDefinedMetadata != null) {\n        result.userDefinedMetadata =
modelJSON.userDefinedMetadata;\n    }\n    if (modelJSON.modelInitializer != null) {\n

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result.modelInitializer = modelJSON.modelInitializer;\n
    }\n    resolve(result);\n    }\n    });\n    weightFileReader.onerror = error =>\n    reject(`Failed to weights data from file of path '${path}'.`);\n
weightFileReader.readAsArrayBuffer(pathToFile[path]);\n    });\n    });\n    });\n    jsonReader.onerror =\nerror => reject(\n    `Failed to read model topology and weights manifest JSON ` +\n    `from file\n    '${jsonFile.name}'. BrowserFiles supports loading ` +\n    `Keras-style tf.Model artifacts only.`);\n
jsonReader.readAsText(jsonFile);\n    });\n    }\n\n    /**\n    * Check the compatibility between weights manifest and\n    weight files.\n    */\n    private checkManifestAndWeightFiles(\n    manifest: WeightsManifestConfig, files: File[]):\n    {[path: string]: File} {\n    const basenames: string[] = [];\n    const fileNames = files.map(file =>\n    basename(file.name));\n    const pathToFile: {[path: string]: File} = {};\n    for (const\n    group of manifest) {\n    group.paths.forEach(path => {\n    const pathBasename = basename(path);\n    if\n    (basenames.indexOf(pathBasename) !== -1) {\n    throw new Error(\n    `Duplicate file basename found in\n    weights manifest: ` +\n    ` '${pathBasename}'`);\n    }\n    basenames.push(pathBasename);\n    if\n    (fileNames.indexOf(pathBasename) === -1) {\n    throw new Error(\n    `Weight file with basename\n    '${pathBasename}' is not provided.`);\n    } else {\n    pathToFile[path] =\n    files[fileNames.indexOf(pathBasename)];\n    }\n    });\n    }\n\n    if (basenames.length !== files.length) {\n    throw new Error(\n    `Mismatch in the number of files in weights manifest ` +\n    ` (${basenames.length})\n    and the number of weight files provided ` +\n    ` (${files.length}).`);\n    }\n    return pathToFile;\n    }\n\n}\n\nexport const browserDownloadsRouter: IORouter = (url: string|string[]) => {\n    if (!env().getBool('IS_BROWSER')) {\n    return null;\n    } else {\n    if (!Array.isArray(url) &&\n    url.startsWith(BrowserDownloads.URL_SCHEME)) {\n    return\n    browserDownloads(url.slice(BrowserDownloads.URL_SCHEME.length));\n    } else {\n    return null;\n    }\n    }\n\n}\n\nIORouterRegistry.registerSaveRouter(browserDownloadsRouter);\n\n/**\n * Creates an IOHandler that\n triggers file downloads from the browser.\n */\n * The returned `IOHandler` instance can be used as model exporting\n methods such\n * as `tf.Model.save` and supports only saving.\n */\n * ``js\n * const model = tf.sequential();\n * model.add(tf.layers.dense({\n *   units: 1, inputShape: [10], activation: 'sigmoid'}));\n * const saveResult = await\n model.save('downloads://mymodel');\n * // This will trigger downloading of two files:\n * // 'mymodel.json' and\n * 'mymodel.weights.bin'.\n * console.log(saveResult);\n * ``\n */\n * @param fileNamePrefix Prefix name of the files\n to be downloaded. For use with\n * `tf.Model`,\n * `fileNamePrefix` should follow either of the following two\n * formats:\n * 1. `null` or `undefined`, in which\n case the default file\n * names will be used:\n * - 'model.json' for the JSON file containing the model topology\n and\n * weights manifest.\n * - 'model.weights.bin' for the binary file containing the binary weight\n * values.\n * 2. A single string or an Array of a single string, as the file name prefix.\n * For example, if `foo` is\n provided, the downloaded JSON\n * file and binary weights file will be named 'foo.json' and\n * 'foo.weights.bin', respectively.\n * @param config Additional configuration for triggering downloads.\n * @returns\n An instance of `BrowserDownloads` `IOHandler`.\n */\n * @doc {\n * heading: 'Models',\n * subheading:\n 'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n */\n\nexport function browserDownloads(fileNamePrefix =\n'model'): IOHandler {\n    return new BrowserDownloads(fileNamePrefix);\n}\n\n/**\n * Creates an IOHandler that loads model artifacts from user-selected files.\n */\n * This method can be used for\n loading from files such as user-selected files\n * in the browser.\n * When used in conjunction with\n `tf.loadLayersModel`, an instance of\n * `tf.LayersModel` (Keras-style) can be constructed from the loaded\n artifacts.\n */\n * ``js\n * // Note: This code snippet won't run properly without the actual file input\n * // elements\n in the HTML DOM.\n * // Suppose there are two HTML file input (<input type="file" ...>)\n * // elements.\n * const uploadJSONInput = document.getElementById('upload-json');\n * const uploadWeightsInput =\n document.getElementById('upload-weights');\n * const model = await tf.loadLayersModel(tf.io.browserFiles([\n * uploadJSONInput.files[0], uploadWeightsInput.files[0]]));\n * ``\n */\n * @param files `File`s to load from.\n Currently, this function supports only\n * loading from files that contain Keras-style models (i.e., `tf.Model`s),

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for\n * which an `Array` of `File`s is expected (in that order):\n * - A JSON file containing the model topology and weight manifest.\n * - Optionally, One or more binary files containing the binary weights.\n * These files must have names that match the paths in the `weightsManifest`\n * contained by the aforementioned JSON file, or errors will be thrown\n * during loading. These weights files have the same format as the ones\n * generated by `tensorflowjs_converter` that comes with the `tensorflowjs`\n * Python PIP package. If no weights files are provided, only the model\n * topology will be loaded from the JSON file above.\n * @returns An instance of `Files` `IOHandler`.\n * @doc {\n * heading: 'Models',\n * subheading: 'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n * ^\n * export function browserFiles(files: File[]): IOHandler {\n * return new BrowserFiles(files);\n * }\n * ,"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * }

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*\n\nimport {assert} from './util';\n\nimport {OnProgressCallback} from './types';\n\n/**\n * Monitor Promise.all progress, fire onProgress callback function.\n * @param promises Promise list going to be monitored\n * @param onProgress Callback function. Fired when a promise resolved.\n * @param startFraction Optional fraction start. Default to 0.\n * @param endFraction Optional fraction end. Default to 1.\n * ^\n * export function monitorPromisesProgress(\n * promises: Array<Promise<{}>|void>>, onProgress: OnProgressCallback,\n * startFraction?: number, endFraction?: number) {\n * checkPromises(promises);\n * startFraction = startFraction == null ? 0 : startFraction;\n * endFraction = endFraction == null ? 1 : endFraction;\n * checkFraction(startFraction, endFraction);\n * let resolvedPromise = 0;\n * const registerMonitor = (promise: Promise<{}>) => {\n * promise.then(value => {\n * const fraction = startFraction +\n * ++resolvedPromise / promises.length * (endFraction - startFraction);\n * // pass fraction as parameter to callback function.\n * onProgress(fraction);\n * return value;\n * });\n * return promise;\n * };\n * function checkPromises(promises: Array<Promise<{}>|void>>): void {\n * assert(\n * promises != null && Array.isArray(promises) && promises.length > 0,\n * () => 'promises must be a none empty array');\n * }\n * function checkFraction(startFraction: number, endFraction: number): void {\n * assert(\n * startFraction >= 0 && startFraction <= 1,\n * () => `Progress fraction must be in range [0, 1], but ` +\n * `got startFraction ${startFraction}`);\n * assert(\n * endFraction >= 0 && endFraction <= 1,\n * () => `Progress fraction must be in range [0, 1], but ` +\n * `got endFraction ${endFraction}`);\n * assert(\n * endFraction >= startFraction,\n * () => `startFraction must be no more than endFraction, but ` +\n * `got startFraction ${startFraction} and endFraction ` +\n * `${endFraction}`);\n * }\n * return Promise.all(promises.map(registerMonitor));\n * }\n * ,"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * }
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*\n\nimport {env} from './environment';\n\nimport {NamedTensorMap} from './tensor_types';\n\nimport * as util from './util';\n\nimport {decodeWeights} from './io_utils';\n\nimport {monitorPromisesProgress} from './progress';\n\nimport {DTYPE_VALUE_SIZE_MAP, LoadOptions, WeightsManifestConfig, WeightsManifestEntry} from './types';\n\n/**\n * Reads binary weights data from a number of URLs.\n * @param fetchURLs URLs to send the HTTP requests at, using `fetch` calls.\n * @param requestOptions RequestInit
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(options) for the HTTP requests.\n * @param fetchFunc Optional overriding value for the `window.fetch`
function.\n * @param onProgress Optional, progress callback function, fired periodically\n * before the load is
completed.\n * @returns A `Promise` of an Array of `ArrayBuffer`. The Array has the same\n * length as
`fetchURLs`.\n * ^/nextport async function loadWeightsAsArrayBuffer(\n fetchURLs: string[], loadOptions?:
LoadOptions): Promise<ArrayBuffer[]> {\n if (loadOptions == null) {\n loadOptions = {};\n }\n\n const
fetchFunc = loadOptions.fetchFunc == null ? env().platform.fetch :\n
loadOptions.fetchFunc;\n\n // Create the requests for all of the weights in parallel.\n const requests =
fetchURLs.map(\n fetchURL =>\n fetchFunc(fetchURL, loadOptions.requestInit, {isBinary: true}));\n\n
const fetchStartFraction = 0;\n const fetchEndFraction = 0.5;\n\n const responses = loadOptions.onProgress == null
?\n await Promise.all(requests) :\n await monitorPromisesProgress(\n requests, loadOptions.onProgress,
fetchStartFraction,\n fetchEndFraction);\n\n const bufferPromises = responses.map(response =>
response.arrayBuffer());\n\n const bufferStartFraction = 0.5;\n const bufferEndFraction = 1;\n\n const buffers =
loadOptions.onProgress == null ?\n await Promise.all(bufferPromises) :\n await monitorPromisesProgress(\n
bufferPromises, loadOptions.onProgress, bufferStartFraction,\n bufferEndFraction);\n return
buffers;\n}\n\n/**\n * Reads a weights manifest JSON configuration, fetches the weights and\n * returns them as
`Tensor`s.\n * ^\n * @param manifest The weights manifest JSON.\n * @param filePathPrefix The path prefix for
filenames given in the manifest.\n * Defaults to the empty string.\n * @param weightNames The names of the
weights to be fetched.\n * ^/nextport async function loadWeights(\n manifest: WeightsManifestConfig,
filePathPrefix = "",\n weightNames?: string[],\n requestInit?: RequestInit): Promise<NamedTensorMap> {\n //
TODO(nsthorat): Groups are currently fetched atomically. If you need a\n // single weight from a group, the whole
group will be fetched. At a future\n // date, we should support fetching only the individual shards within a\n //
group that are needed to reconstruct the requested weight.\n // TODO(cais): Use `decodeWeights` for
implementation.\n\n const fetchWeights = (fetchUrls: string[]) =>\n loadWeightsAsArrayBuffer(fetchUrls,
{requestInit});\n const loadWeights = weightsLoaderFactory(fetchWeights);\n\n return loadWeights(manifest,
filePathPrefix, weightNames);\n}\n\n/**\n * Creates a function, which reads a weights manifest JSON
configuration,\n * fetches the weight files using the specified function and returns them as\n * `Tensor`s.\n * ^\n *
`js`\n * // example for creating a nodejs weight loader, which reads the weight files\n * // from disk using
fs.readFileSync\n
*\n * import * as fs from 'fs'\n * ^\n * const fetchWeightsFromDisk = (filePaths: string[]) =>\n *
filePaths.map(filePath => fs.readFileSync(filePath).buffer)\n * ^\n * const loadWeights =
tf.io.weightsLoaderFactory(fetchWeightsFromDisk)\n * ^\n * const manifest = JSON.parse(\n *
fs.readFileSync('./my_model-weights_manifest').toString())\n * ^\n * const weightMap = await
loadWeights(manifest, './')\n * ^\n * @param fetchWeightsFunction The function used for fetching the weight
files.\n * @returns Weight loading function.\n * ^/nextport function weightsLoaderFactory(\n
fetchWeightsFunction: (fetchUrls: string[]) => Promise<ArrayBuffer[]>):\n (manifest: WeightsManifestConfig,
filePathPrefix?: string,\n weightNames?: string[]) => Promise<NamedTensorMap> {\n return async(\n
manifest: WeightsManifestConfig, filePathPrefix = "",\n weightNames?: string[]):
Promise<NamedTensorMap> => {\n // Collect all the groups, weights, and their relative offsets
to be\n // fetched.\n const groupIndicesToFetchMap = manifest.map(() => false);\n const
groupWeightsToFetch: {\n [group: number]: Array<{\n manifestEntry: WeightsManifestEntry; groupOffset:
number;\n sizeBytes: number;\n }>\n } = {};\n const weightsFound =\n weightNames != null ?
weightNames.map(() => false) : [];\n const allManifestWeightNames: string[] = [];\n
manifest.forEach((manifestGroupConfig, groupIndex) => {\n let groupOffset = 0;\n
manifestGroupConfig.weights.forEach(weightsEntry => {\n const rawDtype = ('quantization' in weightsEntry)
?\n weightsEntry.quantization.dtype :\n weightsEntry.dtype;\n\n const weightsBytes =
DTYPE_VALUE_SIZE_MAP[rawDtype] *\n util.sizeFromShape(weightsEntry.shape);\n\n const
enqueueWeightsForFetchingFn = () => {\n groupIndicesToFetchMap[groupIndex] = true;\n if
(groupWeightsToFetch[groupIndex] == null) {\n

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        groupWeightsToFetch[groupIndex] = [];\n        }\n        groupWeightsToFetch[groupIndex].push({\n
manifestEntry: weightsEntry,\n        groupOffset,\n        sizeBytes: weightsBytes\n        });\n        });\n        if
(weightNames != null) {\n        weightNames.forEach((weightName, weightIndex) => {\n        if (weightName
=== weightsEntry.name) {\n        enqueueWeightsForFetchingFn();\n        weightsFound[weightIndex] =
true;\n        }\n        });\n        } else {\n        enqueueWeightsForFetchingFn();\n        }\n
allManifestWeightNames.push(weightsEntry.name);\n        groupOffset += weightsBytes;\n        });\n        });\n        if
(!weightsFound.every(found => found)) {\n        const weightsNotFound = weightNames.filter((_, i) =>
!weightsFound[i]);\n        throw new Error(\n        `Could not find weights in manifest with names: ` +\n
`${weightsNotFound.join(', ')}. \\\n` +\n        `Manifest JSON has
weights with names: ` +\n        `${allManifestWeightNames.join(', ')}`);\n        }\n        // Convert the one-hot boolean
groupId => shouldFetch map to a list of group\n        // IDs.\n        const groupIndicesToFetch =\n
groupIndicesToFetchMap.reduce((accumulator, shouldFetch, i) => {\n        if (shouldFetch) {\n
accumulator.push(i);\n        }\n        return accumulator;\n        }, []);\n        const fetchUrls: string[] = [];\n
groupIndicesToFetch.forEach(i => {\n        manifest[i].paths.forEach(filepath => {\n        const fetchUrl =
filePathPrefix +\n        (!filePathPrefix.endsWith('/') ? '/' : '') + filepath;\n        fetchUrls.push(fetchUrl);\n        });\n
});\n        const buffers = await fetchWeightsFunction(fetchUrls);\n        const weightsTensorMap: NamedTensorMap =
{};\n        let bufferIndexOffset = 0;\n        groupIndicesToFetch.forEach(i => {\n        const numBuffers =
manifest[i].paths.length;\n        let groupBytes = 0;\n        for (let i = 0; i <
numBuffers; i++) {\n        groupBytes += buffers[bufferIndexOffset + i].byteLength;\n        }\n        // Create a buffer
for the whole group.\n        const groupBuffer = new ArrayBuffer(groupBytes);\n        const groupByteBuffer = new
Uint8Array(groupBuffer);\n        let groupBufferOffset = 0;\n        for (let i = 0; i < numBuffers; i++) {\n        const
buffer = new Uint8Array(buffers[bufferIndexOffset + i]);\n        groupByteBuffer.set(buffer, groupBufferOffset);\n
groupBufferOffset += buffer.byteLength;\n        }\n        const weightsEntries = groupWeightsToFetch[i];\n
weightsEntries.forEach(weightsEntry => {\n        const byteBuffer = groupBuffer.slice(\n
weightsEntry.groupOffset,\n        weightsEntry.groupOffset + weightsEntry.sizeBytes);\n        const
nameToTensorMap =\n        decodeWeights(byteBuffer, [weightsEntry.manifestEntry]);\n        for (const name in
nameToTensorMap) {\n        weightsTensorMap[name] = nameToTensorMap[name];\n        }\n
});\n        bufferIndexOffset += numBuffers;\n        });\n        return weightsTensorMap;\n        });\n        }\n
}\n        @license\n        * Copyright 2018 Google LLC. All Rights Reserved.\n        * Licensed under the Apache License, Version
2.0 (the "License");\n        * you may not use this file except in compliance with the License.\n        * You may obtain a
copy of the License at\n        * http://www.apache.org/licenses/LICENSE-2.0\n        * Unless required by applicable
law or agreed to in writing, software\n        * distributed under the License is distributed on an "AS IS" BASIS,\n        *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n        * See the License for
the specific language governing permissions and\n        * limitations under the License.\n        *
\n        =====\n
*\n        *\n        * IOHandler implementations based on HTTP requests in the web browser.\n        *\n        * Uses
[ fetch` ](https://developer.mozilla.org/en-US/docs/Web/API/Fetch\_API).\n        *\n        *\n
import\n        { env } from './environment';\n        *\n        *\n        import { assert } from './util';\n        *\n        *\n        import { concatenateArrayBuffers,\n        getModelArtifactsInfoForJSON } from './io_utils';\n        *\n        *\n        import { IORouter, IORouterRegistry } from
'/router_registry';\n        *\n        *\n        import { IOHandler, LoadOptions, ModelArtifacts, ModelJSON, OnProgressCallback,\n        SaveResult, WeightsManifestConfig, WeightsManifestEntry } from './types';\n        *\n        *\n        import { loadWeightsAsArrayBuffer }
from './weights_loader';\n        *\n        *\n        const OCTET_STREAM_MIME_TYPE = 'application/octet-stream';\n        *\n        *\n        const
JSON_TYPE = 'application/json';\n        *\n        *\n        export class HTTPRequest implements IOHandler {\n        *\n        *\n        protected readonly path:\n        string;\n        *\n        *\n        protected readonly requestInit: RequestInit;\n        *\n        *\n        private readonly fetch: Function;\n        *\n        *\n        private readonly
weightUrlConverter: (weightName: string) => Promise<string>;\n        *\n        *\n        readonly DEFAULT_METHOD = 'POST';\n        *\n        *\n        static readonly URL_SCHEME_REGEX = /^https?:\\|\\|/;\n        *\n        *\n        private readonly weightPathPrefix: string;\n        *\n        *\n        private
readonly onProgress: OnProgressCallback;\n        *\n        *\n        constructor(path:

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string, loadOptions?: LoadOptions) {\n  if (loadOptions == null) {\n    loadOptions = {};\n  }\n  this.weightPathPrefix = loadOptions.weightPathPrefix;\n  this.onProgress = loadOptions.onProgress;\n  this.weightUrlConverter = loadOptions.weightUrlConverter;\n  if (loadOptions.fetchFunc != null) {\n    assert(\n      typeof loadOptions.fetchFunc === 'function',\n      () => 'Must pass a function that matches the\n      signature of ' +\n        `fetch` (see ' +\n        `https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API`);\n    this.fetch = loadOptions.fetchFunc;\n  } else {\n    this.fetch =\n      env().platform.fetch;\n  }\n  assert(\n    path != null && path.length > 0,\n    () => 'URL path for http must\n    not be null, undefined or ' +\n    `empty.`);\n  if (Array.isArray(path)) {\n    assert(\n      path.length ===\n      2,\n      () => 'URL paths for http must have a length of 2, ' +\n      `actual\n      length is ${path.length}`);\n  }\n  this.path = path;\n  if (loadOptions.requestInit != null &&\n    loadOptions.requestInit.body != null) {\n    throw new Error(\n      `requestInit is expected to have no pre-\n      existing body, but has one.`);\n  }\n  this.requestInit = loadOptions.requestInit || {};\n}\n\nasync\nsave(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n  if (modelArtifacts.modelTopology instanceof\n    ArrayBuffer) {\n    throw new Error(\n      `BrowserHTTPRequest.save() does not support saving model topology\n      ' +\n      `in binary formats yet.`);\n  }\n  const init = Object.assign({ method: this.DEFAULT_METHOD },\n    this.requestInit);\n  init.body = new FormData();\n  const weightsManifest: WeightsManifestConfig = [{\n    paths: ['./model.weights.bin'],\n    weights: modelArtifacts.weightSpecs,\n  }];\n  const\n    modelTopologyAndWeightManifest: ModelJSON = {\n    modelTopology: modelArtifacts.modelTopology,\n    format:\n      modelArtifacts.format,\n    generatedBy: modelArtifacts.generatedBy,\n    convertedBy:\n      modelArtifacts.convertedBy,\n    weightsManifest\n  }; \n  if (modelArtifacts.signature != null) {\n    modelTopologyAndWeightManifest.signature = modelArtifacts.signature;\n  }\n  if\n    (modelArtifacts.userDefinedMetadata != null) {\n    modelTopologyAndWeightManifest.userDefinedMetadata =\n      modelArtifacts.userDefinedMetadata;\n  }\n  if (modelArtifacts.modelInitializer != null) {\n    modelTopologyAndWeightManifest.modelInitializer =\n      modelArtifacts.modelInitializer;\n  }\n  init.body.append(\n    `model.json`,\n    new Blob([\n      JSON.stringify(modelTopologyAndWeightManifest),\n      { type: JSON_TYPE },\n      `model.json`]);\n  }\n  if\n    (modelArtifacts.weightData != null) {\n    init.body.append(\n      `model.weights.bin`,\n      new\n        Blob([modelArtifacts.weightData], { type: OCTET_STREAM_MIME_TYPE },\n          `model.weights.bin`);\n    );\n  }\n  const response = await this.fetch(this.path, init);\n  if (response.ok) {\n    return {\n      modelArtifactsInfo: getModelArtifactsInfoForJSON(modelArtifacts),\n      responses: [response],\n    }; \n  } else {\n    throw new Error(\n      `BrowserHTTPRequest.save() failed due to HTTP response status ` +\n      `${response.status}`);\n  }\n}\n\n/**\n * Load model artifacts via HTTP request(s).\n * See the\n * documentation to `tf.io.http` for details on the saved\n * artifacts.\n * @returns The loaded model artifacts (if\n * loading succeeds).\n */\nasync load(): Promise<ModelArtifacts> {\n  const modelConfigRequest = await\n    this.fetch(this.path, this.requestInit);\n  if (!modelConfigRequest.ok) {\n    throw new Error(\n      `Request to\n      ${this.path} failed with status code ` +\n      `${modelConfigRequest.status}. Please verify this URL points to ` +\n      `the model JSON of the model to\n      load.`);\n  }\n  let modelConfig: ModelJSON;\n  try {\n    modelConfig = await modelConfigRequest.json();\n  } catch (e) {\n    let message = `Failed to parse model JSON of response from ${this.path}`;\n    //\n    // TODO(nsthorat): Remove this after some time when we're comfortable that\n    // .pb files are mostly gone.\n    if\n      (this.path.endsWith('.pb')) {\n      message += ` Your path contains a .pb file extension. ` +\n        `Support for .pb\n        models have been removed in TensorFlow.js 1.0 ` +\n        `in favor of .json models. You can re-convert your\n        Python ` +\n        `TensorFlow model using the TensorFlow.js 1.0 conversion scripts ` +\n        `or you can\n        convert your.pb models with the \\pb2json` +\n        `NPM script in the tensorflow/tfjs-converter repository.`;\n    }\n    else {\n      message += ` Please make sure the server is serving valid ` +\n        `JSON for this request.`;\n    }\n  }\n  throw new Error(message);\n}\n

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const modelTopology = modelConfig.modelTopology;\n const weightsManifest =
modelConfig.weightsManifest;\n const generatedBy = modelConfig.generatedBy;\n const convertedBy =
modelConfig.convertedBy;\n const format = modelConfig.format;\n const signature = modelConfig.signature;\n
const userDefinedMetadata = modelConfig.userDefinedMetadata;\n\n // We do not allow both modelTopology
and weightsManifest to be missing.\n if (modelTopology == null && weightsManifest == null) {\n throw new
Error(\n `The JSON from HTTP path ${this.path} contains neither model ` +\n `topology or manifest for
weights.`);\n }\n\n let weightSpecs: WeightsManifestEntry[];\n let weightData: ArrayBuffer;\n if
(weightsManifest != null) {\n const results = await this.loadWeights(weightsManifest);\n [weightSpecs,
weightData] = results;\n }\n\n const artifacts: ModelArtifacts = {\n modelTopology,\n weightSpecs,\n
weightData,\n
generatedBy,\n convertedBy,\n format\n };\n\n if (signature != null) {\n artifacts.signature =
signature;\n }\n if (userDefinedMetadata != null) {\n artifacts.userDefinedMetadata =
userDefinedMetadata;\n }\n\n const initializer = modelConfig.modelInitializer;\n if (initializer) {\n
artifacts.modelInitializer = initializer;\n }\n\n return artifacts;\n }\n\n private async
loadWeights(weightsManifest: WeightsManifestConfig): Promise<[WeightsManifestEntry[], ArrayBuffer]>
{\n const weightPath = Array.isArray(this.path) ? this.path[1] : this.path;\n const [prefix, suffix] =
parseUrl(weightPath);\n const pathPrefix = this.weightPathPrefix || prefix;\n\n const weightSpecs = [];\n for
(const entry of weightsManifest) {\n weightSpecs.push(...entry.weights);\n }\n\n const fetchURLs: string[] =
[];\n const urlPromises: Array<Promise<string>> = [];\n for (const weightsGroup of weightsManifest) {\n
for (const path of weightsGroup.paths) {\n if (this.weightUrlConverter != null) {\n
urlPromises.push(this.weightUrlConverter(path));\n } else {\n fetchURLs.push(pathPrefix + path +
suffix);\n }\n }\n }\n\n if (this.weightUrlConverter) {\n fetchURLs.push(...await
Promise.all(urlPromises));\n }\n\n const buffers = await loadWeightsAsArrayBuffer(fetchURLs, {\n
requestInit: this.requestInit,\n fetchFunc: this.fetch,\n onProgress: this.onProgress\n });\n return
[weightSpecs, concatenateArrayBuffers(buffers)];\n }\n\n\n * Extract the prefix and suffix of the url, where
the prefix is the path before\n * the last file, and suffix is the search params after the last file.\n * ```\n * const url =
'http://tfhub.dev/model/1/tensorflowjs_model.pb?tfjs-format=file'\n * [prefix, suffix] = parseUrl(url)\n * // prefix =
'http://tfhub.dev/model/1/'\n * // suffix = '?tfjs-format=file'\n * ```\n * @param url the model
url to be parsed.\n *\nexport function parseUrl(url: string): [string, string] {\n const lastSlash =
url.lastIndexOf('/');\n const lastSearchParam = url.lastIndexOf('?');\n const prefix = url.substring(0, lastSlash);\n
const suffix =\n lastSearchParam > lastSlash ? url.substring(lastSearchParam) : '';\n return [prefix + '/',
suffix];\n }\n\nexport function isHTTPS(url: string): boolean {\n return
url.match(HTTPRequest.URL_SCHEME_REGEX) != null;\n}\n\nexport const httpRouter: IORouter =\n (url:
string, loadOptions?: LoadOptions) => {\n if (typeof fetch === 'undefined' &&\n (loadOptions == null ||
loadOptions.fetchFunc == null)) {\n // `http` uses `fetch` or `node-fetch`, if one wants to use it in\n // an
environment that is not the browser or node they have to setup a\n // global fetch polyfill.\n return null;\n
}\n let isHTTP = true;\n if (Array.isArray(url)) {\n isHTTP = url.every(urlItem
=> isHTTPScheme(urlItem));\n } else {\n isHTTP = isHTTPScheme(url);\n }\n if (isHTTP) {\n
return http(url, loadOptions);\n }\n }\n return null;\n
};\n\nIORouterRegistry.registerSaveRouter(httpRouter);\nIORouterRegistry.registerLoadRouter(httpRouter);\n\n\n *
Creates an IOHandler subtype that sends model artifacts to HTTP server.\n * An HTTP request of the
`multipart/form-data` mime type will be sent to the\n * `path` URL. The form data includes artifacts that represent
the topology\n * and/or weights of the model. In the case of Keras-style `tf.Model`, two\n * blobs (files) exist in
form-data:\n * - A JSON file consisting of `modelTopology` and `weightsManifest`.\n * - A binary weights file
consisting of the concatenated weight values.\n * These files are in the same format as the one generated by\n *
[tfjs_converter](https://js.tensorflow.org/tutorials/import-keras.html).\n * The following code snippet
exemplifies

```

the client-side code that uses this function:

```

const model = tf.sequential();
model.add(tf.layers.dense({units: 1, inputShape: [100], activation: 'sigmoid'}));
const saveResult = await model.save(tf.io.http('http://model-server:5000/upload', {requestInit: {method: 'PUT'}}));
console.log(saveResult);

```

If the default `POST` method is to be used, without any custom parameters such as headers, you can simply pass an HTTP or HTTPS URL to `model.save`:

```

const saveResult = await model.save('http://model-server:5000/upload');

```

The following GitHub Gist <https://gist.github.com/dsmilkov/1b6046fd6132d7408d5257b0976f7864> implements a server based on [flask](https://github.com/pallets/flask) that can receive the request. Upon receiving the model artifacts via the request, this particular server reconstitutes instances of [Keras Models](https://keras.io/models/model/) in memory.

@param path A URL path to the model. Can be an absolute HTTP path (e.g., `http://localhost:8000/model-upload`) or a relative path (e.g., `./model-upload`).

@param requestInit Request configurations to be used when sending HTTP request to server using `fetch`. It can contain fields such as `method`, `credentials`, `headers`, `mode`, etc. See <https://developer.mozilla.org/en-US/docs/Web/API/Request/Request> for more information. `requestInit` must not have a body, because the body will be set by TensorFlow.js. File blobs representing the model topology (filename: 'model.json') and the weights of the model (filename: 'model.weights.bin') will be appended to the body. If `requestInit` has a `body`, an Error will be thrown.

@param loadOptions Optional configuration for the loading. It includes the following fields:

- weightPathPrefix** Optional, this specifies the path prefix for weight files, by default this is calculated from the path param.
- fetchFunc** Optional, custom `fetch` function. E.g., in Node.js, the `fetch` from node-fetch can be used here.
- onProgress** Optional, progress callback function, fired periodically before the load is completed.

@returns An instance of `IOHandler`.

@doc {
 heading: 'Models',
 subheading: 'Loading',
 namespace: 'io',
 ignoreCI: true
}

```

export function http(path: string, loadOptions?: LoadOptions): IOHandler {
  return new HTTPRequest(path, loadOptions);
}

```

Deprecated. Use `tf.io.http`.

```

export function browserHTTPRequest(path: string, loadOptions?: LoadOptions): IOHandler {
  return http(path, loadOptions);
}

```

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```

=====
import {IOHandler, ModelArtifacts, SaveResult, TrainingConfig, WeightsManifestEntry} from './types';
class PassthroughLoader implements IOHandler {
  constructor(private readonly modelArtifacts?: ModelArtifacts) {}
  async load(): Promise<ModelArtifacts> {
    return this.modelArtifacts;
  }
}
class PassthroughSaver implements IOHandler {
  constructor(private readonly saveHandler: (artifacts: ModelArtifacts) => Promise<SaveResult>) {}
  async save(modelArtifacts: ModelArtifacts) {
    return this.saveHandler(modelArtifacts);
  }
}

```

Creates an IOHandler that loads model artifacts from memory.

When used in conjunction with `tf.loadLayersModel`, an instance of `tf.LayersModel` (Keras-style) can be constructed from the loaded artifacts.

```

const model = await tf.loadLayersModel(tf.io.fromMemory(modelTopology, weightSpecs, weightData));

```

@param modelArtifacts a object containing model topology (i.e., parsed from the JSON format).

@param weightSpecs An array of `WeightsManifestEntry` objects describing the names, shapes, types, and quantization of the weight data.

@param weightData A single `ArrayBuffer` containing the weight data, concatenated in the order described by the `weightSpecs`.

@param trainingConfig Model training configuration.

```

Optional.\n *\n * @returns A passthrough `IOHandler` that simply loads the provided data.\n *\nexport function
fromMemory(\n  modelArtifacts: {}|ModelArtifacts, weightSpecs?: WeightsManifestEntry[],\n  weightData?:
ArrayBuffer, trainingConfig?: TrainingConfig): IOHandler {\n  if (arguments.length === 1) {\n  const
isModelArtifacts =\n    (modelArtifacts as ModelArtifacts).modelTopology != null ||\n    (modelArtifacts as
ModelArtifacts).weightSpecs != null;\n  if (isModelArtifacts) {\n    return new PassthroughLoader(modelArtifacts
as ModelArtifacts);\n  } else {\n    // Legacy support: with only modelTopology.\n    // TODO(cais): Remove this
deprecated API.\n    console.warn(\n      'Please call tf.io.fromMemory() with only one argument. ' +\n      'The
argument should be of type ModelArtifacts. ' +\n      'The multi-argument signature of tf.io.fromMemory() has
been ' +\n      'deprecated and will be removed in a future release.);\n    return
new PassthroughLoader({modelTopology: modelArtifacts as {}});\n  }\n } else {\n // Legacy support.\n //
TODO(cais): Remove this deprecated API.\n  console.warn(\n    'Please call tf.io.fromMemory() with only one
argument. ' +\n    'The argument should be of type ModelArtifacts. ' +\n    'The multi-argument signature of
tf.io.fromMemory() has been ' +\n    'deprecated and will be removed in a future release.);\n  return new
PassthroughLoader({\n    modelTopology: modelArtifacts as {},\n    weightSpecs,\n    weightData,\n
trainingConfig\n  });\n }\n}\n\n/**\n * Creates an IOHandler that passes saved model artifacts to a callback.\n *\n
* ``js\n * function handleSave(artifacts) {\n * // ... do something with the artifacts ...*\n * return
{modelArtifactsInfo: {...}, ...};\n * }\n *\n * const saveResult = model.save(tf.io.withSaveHandler(handleSave));\n
* ``\n *\n * @param saveHandler A function that accepts a `ModelArtifacts` and returns
a\n * `SaveResult`.\n *\nexport function withSaveHandler(\n  saveHandler: (artifacts: ModelArtifacts) =>\n
Promise<SaveResult>): IOHandler {\n  return new PassthroughSaver(saveHandler);\n }\n\n"/**\n *\n * @license\n *
Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n
=====

```

```

*\n\n// Importing local_storage and indexed_db is necessary for the routers
to be\n// registered.\nimport './indexed_db';\nimport './local_storage';\nimport {browserFiles} from
'/browser_files';\nimport {browserHTTPRequest, http, isHTTPScheme} from './http';\nimport
{concatenateArrayBuffers, decodeWeights, encodeWeights, getModelArtifactsInfoForJSON} from
'/io_utils';\nimport {fromMemory, withSaveHandler} from './passthrough';\nimport {getLoadHandlers,
getSaveHandlers, registerLoadRouter, registerSaveRouter} from './router_registry';\nimport {IOHandler,
LoadHandler, LoadOptions, ModelArtifacts, ModelArtifactsInfo, ModelJSON, ModelStoreManager,
OnProgressCallback, RequestDetails, SaveConfig, SaveHandler, SaveResult, WeightGroup,
WeightsManifestConfig, WeightsManifestEntry} from './types';\nimport {loadWeights, weightsLoaderFactory}
from './weights_loader';\nexport {copyModel, listModels, moveModel, removeModel} from
'/model_management';\nexport {\n  browserFiles,\n  browserHTTPRequest,\n  concatenateArrayBuffers,\n
decodeWeights,\n  encodeWeights,\n  fromMemory,\n  getLoadHandlers,\n  getModelArtifactsInfoForJSON,\n
getSaveHandlers,\n  http,\n  IOHandler,\n  isHTTPScheme,\n  LoadHandler,\n  LoadOptions,\n  loadWeights,\n
ModelArtifacts,\n  ModelArtifactsInfo,\n  ModelJSON,\n  ModelStoreManager,\n  OnProgressCallback,\n
registerLoadRouter,\n  registerSaveRouter,\n  RequestDetails,\n  SaveConfig,\n  SaveHandler,\n  SaveResult,\n
WeightGroup,\n  weightsLoaderFactory,\n  WeightsManifestConfig,\n  WeightsManifestEntry,\n  withSaveHandler\n};\n\n"/**\n *\n * @license\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *

```

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* See the License for the specific language governing permissions and
limitations under the License.*

```
=====
*\nimport {ENGINE} from './engine';\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport
 {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from
 './operation';\n\n/**\n * Computes the dot product of two matrices, A * B. These must be matrices.\n *\n * ``js\n *
 const a = tf.tensor2d([1, 2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * \n * a.matMul(b).print(); // or
 tf.matMul(a, b)\n * ``\n * @param a First matrix in dot product operation.\n * @param b Second matrix in dot
 product operation.\n *
 * @param transposeA If true, `a` is transposed before multiplication.\n * @param transposeB If true, `b` is
 transposed before multiplication.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n *\nfunction
 matMul<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike, transposeA = false,\n  transposeB =
 false): T {\n  let $a = convertToTensor(a, 'a', 'matMul');\n  let $b = convertToTensor(b, 'b', 'matMul');\n  [$a, $b] =
 makeTypesMatch($a, $b);\n  \n  const inputs: BatchMatMulInputs = {a: $a, b: $b};\n  const attrs: BatchMatMulAttrs
 = {transposeA, transposeB};\n  \n  return ENGINE.runKernel(\n    BatchMatMul, inputs as { } as NamedTensorMap,\n
 attrs as { } as NamedAttrMap);\n  \n}\n\nexport const matMul = op({matMul_});\n\n"/**\n * @license\n * Copyright
 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
 you may not use this file except in compliance with the License.\n * You may obtain a copy of the
 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
 agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
=====
```

```
=====
*\nimport {ENGINE} from './engine';\nimport {OneHot, OneHotAttrs, OneHotInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Creates a one-hot `tf.Tensor`. The
 locations represented by `indices` take\n * value `onValue` (defaults to 1), while all other locations take
 value\n * `offValue` (defaults to 0). If `indices` is rank `R`, the output has rank\n * `R+1` with the last axis of size
 `depth`.\n *\n * ``js\n * tf.oneHot(tf.tensor1d([0, 1], 'int32'), 3).print();\n * ``\n *\n * @param indices `tf.Tensor` of
 indices with dtype `int32`.\n * @param depth The depth of the one hot dimension.\n * @param onValue A number
 used to fill in the output when the index matches\n * the location.\n * @param offValue A number used to fill in the
 output when the index does\n * not match the location.\n *\n * @doc {heading: 'Tensors', subheading:
 'Creation'}\n *\nfunction oneHot(\n  indices: Tensor|TensorLike, depth: number, onValue = 1,\n  offValue = 0):
 Tensor {\n  if (depth < 2) {\n    throw new Error(`Error in oneHot: depth must be >=2, but it is ${depth}`);\n  }\n  \n
 const $indices = convertToTensor(indices, 'indices', 'oneHot', 'int32');\n  \n  const inputs: OneHotInputs = {indices:
 $indices};\n  const attrs: OneHotAttrs = {depth, onValue, offValue};\n  \n  return ENGINE.runKernel(\n    OneHot,
 inputs as unknown as NamedTensorMap,\n    attrs as unknown as NamedAttrMap);\n  \n}\n\nexport const oneHot =
 op({oneHot_});\n\n"/**\n * @license\n * Copyright 2018 Google
 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
=====
```



```

=====
*\n\nimport {ENGINE} from './engine';\nimport {Transpose, TransposeAttrs, TransposeInputs} from
 './kernel_names';\nimport
 {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Transposes the `tf.Tensor`. Permutates the
 dimensions according to `perm`. \n * The returned `tf.Tensor`'s dimension `i` will correspond to the input \n *
 dimension `perm[i]`. If `perm` is not given, it is set to `[n-1...0]`, \n * where `n` is the rank of the input `tf.Tensor`.
 Hence by default, this \n * operation performs a regular matrix transpose on 2-D input `tf.Tensor`s. \n * ```\n *
 const a = tf.tensor2d([1, 2, 3, 4, 5, 6], [2, 3]);\n * a.transpose().print(); // or tf.transpose(a)\n * ```\n *
 @param x The tensor to transpose.\n * @param perm The permutation of the dimensions of a.\n * @doc
 {heading: 'Operations', subheading: 'Matrices'}\n *\nfunction transpose_<T
 extends Tensor>(x: T|TensorLike, perm?: number[]): T {\n  const $x = convertToTensor(x, 'x', 'transpose');\n  if
 (perm == null) {\n    perm = $x.shape.map((s, i) => i).reverse();\n  }\n  util.assert(\n    $x.rank === perm.length,\n
    () => `Error in transpose: rank of input ${$x.rank} ` +\n      `must match length of perm ${perm}`);\n
  perm.forEach(axis => {\n    util.assert(\n      axis >= 0 && axis < $x.rank,\n      () => `All entries in 'perm' must be
 between 0 and ${$x.rank - 1}` +\n        ` but got ${perm}`);\n  });\n  if ($x.rank <= 1) {\n    return $x.clone();\n
  }\n  const inputs: TransposeInputs = {x: $x};\n  const attrs: TransposeAttrs = {perm};\n  return
 ENGINE.runKernel(\n    Transpose, inputs as {} as NamedTensorMap, attrs as {} as
 NamedAttrMap);\n}\n\nexport const transpose = op({transpose_});\n\n"/**\n * @license\n * Copyright 2018
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n
 * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
 *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
 writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
 WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
 language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\nimport * as util from './util';\n\nimport {cast} from './cast';\nimport {matMul} from
 './mat_mul';\nimport {oneHot} from './one_hot';\nimport {op} from './operation';\nimport {transpose} from
 './transpose';\n\n/**\n * Computes the confusion matrix from true labels and predicted
 labels. \n * ```\n * const labels = tf.tensor1d([0, 1, 2, 1, 0], 'int32');\n * const predictions = tf.tensor1d([0, 2,
 1, 0], 'int32');\n * const numClasses = 3;\n * const out = tf.math.confusionMatrix(labels, predictions, numClasses);\n
 * out.print();\n * // Expected output matrix:\n * // [[2, 0, 0],\n * // [0, 1, 1],\n * // [0, 0, 1]]\n * ```\n *
 @param
 labels The target labels, assumed to be 0-based integers \n * for the classes. The shape is `[numExamples]`, where \n
 * `numExamples` is the number of examples included.\n * @param predictions The predicted classes, assumed to
 be \n * 0-based integers for the classes. Must have the same shape as `labels`. \n * @param numClasses Number of
 all classes, as an integer. \n * Its value must be larger than the largest element in `labels` and \n * `predictions`. \n
 * @returns The confusion matrix as a int32-type 2D tensor. The value at \n * row `r` and column `c` is the number of
 times examples of actual class \n * `r` were
 predicted as class `c`. \n * @doc {heading: 'Operations', subheading: 'Evaluation'}\n *\nexport function
 confusionMatrix_(\n  labels: Tensor1D|TensorLike, predictions: Tensor1D|TensorLike,\n  numClasses: number):
 Tensor2D {\n  const $labels = convertToTensor(labels, 'labels', 'confusionMatrix');\n  const $predictions =\n
 convertToTensor(predictions, 'predictions', 'confusionMatrix');\n  util.assert(\n    numClasses == null ||
 numClasses > 0 && Number.isInteger(numClasses),\n    () => `If provided, numClasses must be a positive integer,
 ` +\n      ` but got ${numClasses}`);\n  util.assert(\n    $labels.rank === 1,\n    () => `Expected the rank of labels
 to be 1, but got ${$labels.rank}`);\n  util.assert(\n    $predictions.rank === 1,\n    () => `Expected the rank of
 predictions to be 1, ` +\n      ` but got ${$predictions.rank}`);\n  util.assert(\n    $labels.shape[0] ===

```

```

$predictions.shape[0],\n    () => `Mismatch in the number of examples: ` +\n
    `${$labels.shape[0]} vs. ${$predictions.shape[0]}. ` +\n
    `Labels and predictions should have the same
number of elements.`);\n util.assert(\n    numClasses > 0 && Number.isInteger(numClasses),\n    () =>
`numClasses is required to be a positive integer, but got ` +\n
    `${numClasses}`);\n // TODO(cais): In the
future, if oneHot supports tensors inputs for\n // `numClasses`, `confusionMatrix` can make `numClasses`
optional.\n\n const oneHotLabels = oneHot(cast($labels, 'int32'), numClasses) as Tensor2D;\n const
oneHotPredictions =\n    oneHot(cast($predictions, 'int32'), numClasses) as Tensor2D;\n const oneHotLabelsT:
Tensor2D = transpose(oneHotLabels);\n const product: Tensor2D = matMul(oneHotLabelsT, oneHotPredictions);\n
return cast(product, 'int32');\n}\n\nexport const confusionMatrix = op({confusionMatrix_});\n", "/**\n * @license\n
* Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\n/**\n * Exports under the tf.math.* namespace.\n */\nimport {confusionMatrix} from
'./ops/confusion_matrix';\n\nexport {confusionMatrix};\n", "/**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor3D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike3D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-3 `tf.Tensor` with the provided values, shape and dtype.\n *
The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor3d` as it makes
the code more readable.\n * \n * ```\n * // Pass a nested array.\n * tf.tensor3d([[[[1,
[2]], [[3], [4]]]].print();\n * \n * ```\n * // Pass a flat array and specify a shape.\n * tf.tensor3d([1, 2, 3, 4], [2, 2,
1]).print();\n * \n * @param values The values of the tensor. Can be nested array of numbers,\n * or a flat
array, or a `TypedArray`.\n * @param shape The shape of the tensor. If not provided, it is inferred from\n *
`values`.\n * @param dtype The data type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\n\nexport
function tensor3d(\n    values: TensorLike3D, shape?: [number, number, number],\n    dtype?: DataType): Tensor3D
{\n    assertNonNull(values);\n    if (shape != null && shape.length !== 3) {\n        throw new Error('tensor3d() requires
shape to have three numbers');\n    }\n    const inferredShape = inferShape(values, dtype);\n    if (inferredShape.length
!== 3 && inferredShape.length !== 1) {\n        throw new Error(\n            'tensor3d() requires values to be number[][][]
or flat/TypedArray');\n    }\n    if (inferredShape.length
=== 1 && shape == null) {\n        throw new Error(\n            'tensor3d() requires shape to be provided when `values`
`
+ \n            `are a flat array`);\n    }\n    return makeTensor(values, shape, inferredShape, dtype) as Tensor3D;\n}\n",
"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport
  {FromPixels, FromPixelsAttrs, FromPixelsInputs} from './kernel_names';\nimport {getKernel, NamedAttrMap}
from './kernel_registry';\nimport {Tensor, Tensor2D, Tensor3D} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {ImageData, TensorLike} from
 './types';\n\nimport {cast} from './cast';\nimport {op} from './operation';\nimport {tensor3d} from './tensor3d';\n\nlet
fromPixels2DContext: CanvasRenderingContext2D;\n\n**\n * Creates a `tf.Tensor` from an image.\n *```\n *
const image = new ImageData(1, 1);\n * image.data[0] = 100;\n * image.data[1] = 150;\n * image.data[2] = 200;\n *
image.data[3] = 255;\n * \n * tf.browser.fromPixels(image).print();\n *```\n * \n * @param pixels The input image to
construct the tensor from. The\n * supported image types are all 4-channel. You can also pass in an image\n * object
with following attributes:\n * `{data: Uint8Array; width: number; height: number}`\n * @param
  numChannels The number of channels of the output tensor. A\n * numChannels value less than 4 allows you to
ignore channels. Defaults to\n * 3 (ignores alpha channel of input image).\n * \n * @doc {heading: 'Browser',
namespace: 'browser', ignoreCI: true}\n */\nfunction fromPixels_(\n  pixels:
  PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n  HTMLVideoElement|ImageBitmap,\n  numChannels = 3): Tensor3D {\n  // Sanity checks.\n  if (numChannels > 4) {\n    throw new Error(\n      'Cannot
construct Tensor with more than 4 channels from pixels.);\n  }\n  if (pixels == null) {\n    throw new Error('pixels
passed to tf.browser.fromPixels() can not be null');\n  }\n  let isPixelData = false;\n  let isImageData = false;\n  let
isVideo = false;\n  let isImage = false;\n  let isCanvasLike = false;\n  let isImageBitmap = false;\n  if ((pixels as
  PixelData).data instanceof Uint8Array) {\n    isPixelData = true;\n  } else if (\n    typeof (ImageData) !==
'undefined' && pixels
instanceof ImageData) {\n    isImageData = true;\n  } else if (\n    typeof (HTMLVideoElement) !== 'undefined'
&&\n    pixels instanceof HTMLVideoElement) {\n    isVideo = true;\n  } else if (\n    typeof
(HTMLImageElement) !== 'undefined' &&\n    pixels instanceof HTMLImageElement) {\n    isImage = true;\n  //
tslint:disable-next-line: no-any\n  } else if ((pixels as any).getContext != null) {\n    isCanvasLike = true;\n  } else if
(\n    typeof (ImageBitmap) !== 'undefined' &&\n    pixels instanceof ImageBitmap) {\n    isImageBitmap =
true;\n  } else {\n    throw new Error(\n      'pixels passed to tf.browser.fromPixels() must be either an `+\n
`HTMLVideoElement, HTMLImageElement, HTMLCanvasElement, ImageData `+\n
`in browser, or
OffscreenCanvas, ImageData in webworker` +\n
` or {data: Uint32Array, width: number, height: number}, `+\n
`but was ${ (pixels as {}).constructor.name}');\n  }\n  if (isVideo) {\n    const
HAVE_CURRENT_DATA_READY_STATE
= 2;\n    if (isVideo &&\n      (pixels as HTMLVideoElement).readyState <\n
HAVE_CURRENT_DATA_READY_STATE) {\n      throw new Error(\n        'The video element has not loaded
data yet. Please wait for `+\n
`loadeddata` event on the <video> element.);\n    }\n  }\n  // If the current
backend has 'FromPixels' registered, it has a more\n  // efficient way of handling pixel uploads, so we call that.\n
const kernel = getKernel(FromPixels, ENGINE.backendName);\n  if (kernel != null) {\n    const inputs:
FromPixelsInputs = {pixels};\n    const attrs: FromPixelsAttrs = {numChannels};\n    return ENGINE.runKernel(\n
      FromPixels, inputs as {} as NamedTensorMap,\n      attrs as {} as NamedAttrMap);\n  }\n  \n  const [width,
height] = isVideo ?\n    [\n      (pixels as HTMLVideoElement).videoWidth,\n      (pixels as
HTMLVideoElement).videoHeight\n    ]:\n    [pixels.width, pixels.height];\n  let vals:
  Uint8ClampedArray|Uint8Array;\n  \n  if (isCanvasLike)
{\n    vals =\n      // tslint:disable-next-line: no-any\n      (pixels as any).getContext('2d').getImageData(0, 0, width,
height).data;\n  } else if (isImageData || isPixelData) {\n    vals = (pixels as PixelData | ImageData).data;\n  } else if
(isImage || isVideo || isImageBitmap) {\n    if (fromPixels2DContext == null) {\n      fromPixels2DContext =
document.createElement('canvas').getContext('2d');\n    }\n    fromPixels2DContext.canvas.width = width;\n
fromPixels2DContext.canvas.height = height;\n    fromPixels2DContext.drawImage(\n      pixels as
HTMLVideoElement, 0, 0, width, height);\n    vals = fromPixels2DContext.getImageData(0, 0, width,
height).data;\n  }\n  \n  let values: Int32Array;\n  if (numChannels === 4) {\n    values = new Int32Array(vals);\n  } else

```



```

(tensorRank < 1) {\n  throw new Error(\n    'tf.gatherND() expects the input to be rank
1 or higher,' +\n    ` but the rank was ${tensorRank}.`);\n } \n if (indicesRank < 1) {\n  throw new Error(\n
'tf.gatherND() expects the indices to be rank 1 or higher,' +\n    ` but the rank was ${indicesRank}.`);\n } \n if
(indices.dtype !== 'int32') {\n  throw new Error(\n    'tf.gatherND() expects the indices to be int32 type,' +\n
` but the dtype was ${indices.dtype}.`);\n } \n if (indices.shape[indicesRank - 1] > tensorRank) {\n  throw new
Error(\n    'index innermost dimension length must be <= tensor rank; saw: ' +\n
`${indices.shape[indicesRank - 1]} vs. ${tensorRank}`);\n } \n \n if (sizeFromShape(tensor.shape) === 0) {\n
throw new Error(\n    'Requested more than 0 entries, but input is empty.' +\n    ` Input shape:
${tensor.shape}.`);\n } \n \n const indicesShape = indices.shape;\n const sliceRank =
indicesShape[indicesShape.length - 1];\n // The result shape is\n // indices.shape[:-1] +
params.shape[indices.shape[-1]:]\n
let nResult = 1;\n for (let i = 0; i < indicesShape.length - 1; ++i) {\n  nResult *= indicesShape[i];\n } \n \n const
inputShape = tensor.shape;\n const resultShape = indicesShape.slice();\n resultShape.pop();\n \n let sliceSize =
1;\n for (let i = sliceRank; i < tensorRank; ++i) {\n  sliceSize *= inputShape[i];\n
resultShape.push(inputShape[i]);\n } \n \n const strides =\n  [...computeStrides(tensor.shape).map(stride => stride
/ sliceSize),\n   1].slice(0, sliceRank);\n \n return [resultShape, nResult, sliceSize, strides];\n } \n } \n
"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\nimport {TensorInfo} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {computeStrides,
sizeFromShape} from '../util';\n\n/**\n * Check whether updates.shape = indices.shape[:batchDim] +\n *
shape[sliceDim:]\n * @param x The input tensor.\n */\nexport function validateUpdateShape(\n  shape:
number[], indices: Tensor, updates: Tensor) {\n  const sliceDim = (indices.rank > 1) ? indices.shape[indices.rank -
1] : 1;\n  const batchDim = (indices.rank > 1) ? indices.rank - 1 : 1;\n  const shapeError = 'Must have
updates.shape = indices.shape[:batchDim] + ` +\n    `shape[sliceDim:], got updates.shape: ${updates.shape}` +\n
`, indices.shape: ${indices.shape}, shape: ${shape}`\n
+\n    `, sliceDim: ${sliceDim}, and batchDim: ${batchDim}.`; \n \n if (updates.rank < batchDim) {\n  throw new
Error(shapeError + ` update.rank < ${batchDim}.`);\n } \n \n if (shape.length < sliceDim + (updates.rank -
batchDim)) {\n  throw new Error(\n    shapeError +\n    ` Output shape length < ${sliceDim + (updates.rank -
batchDim)}`);\n } \n \n if (updates.rank !== batchDim + shape.length - sliceDim) {\n  throw new Error(\n
shapeError + ` update.rank != ${batchDim + shape.length - sliceDim}`);\n } \n \n for (let d = 0; d < batchDim; ++d)
{\n  if (updates.shape[d] !== indices.shape[d]) {\n  throw new Error(\n    shapeError +\n    `
updates.shape[${d}] (${updates.shape[d]}) != indices.shape[${d}] (${indices.shape[d]}.`);\n } \n } \n \n
for (let d = 0; d < updates.rank - batchDim; ++d) {\n  if (updates.shape[d + batchDim] !== shape[d + sliceDim])
{\n  throw new Error(\n    shapeError +\n    ` updates.shape[${d
+ batchDim}] (${updates.shape[d + batchDim]}) != shape[${d + batchDim}] (${shape[d +
batchDim]}.`);\n } \n } \n } \n \n\nexport interface ScatterShapeInfo {\n  sliceRank: number;\n  numUpdates:
number;\n  sliceSize: number;\n  strides: number[];\n  outputSize: number;\n } \n\n/**\n * Validate scatter nd inputs.\n
*\n * @param update The tensor contains the update values.\n * @param indices The tensor contains the indices for
the update values.\n * @param shape The shape of the output tensor.\n */\nexport function validateInput(\n
updates: Tensor, indices: Tensor, shape: number[]) {\n  if (indices.rank < 1) {\n  throw new Error(\n
'tf.scatterND() expects the indices to be rank 1 or higher,' +\n    ` but the rank was ${indices.rank}.`);\n } \n \n
if (updates.rank < 1) {\n  throw new Error(\n    'tf.scatterND() expects the updates to be rank 1 or higher,' +\n
`

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but the rank was ${updates.rank}.`);\n }\n if (indices.dtype !== 'int32')
  {\n   throw new Error(`The dtype of 'indices' should be int32, but got dtype: ${\n     indices.dtype}`);\n }\n if
(shape.length < 1) {\n   throw new Error(\n     `Output rank must be greater or equal to 1, but got shape:
${shape}`);\n }\n\n if (shape.length === 0) {\n   if (indices.size === 0) {\n     throw new Error(`Indices specified
for empty output. indices shape: ${\n       indices.shape}`);\n   }\n   if (updates.size === 0) {\n     throw new
Error(`Updates specified for empty output. updates shape: ${\n       updates.shape}`);\n   }\n }\n\n
validateUpdateShape(shape, indices, updates);\n}\n\n/**\n * Calculate the shape information for the output.\n *\n *
@param update The tensor contains the update values.\n * @param indices The tensor contains the indices for the
update values.\n * @param shape The shape of the output tensor.\n *\n * @returns ScatterShapeInfo\n */\n\nexport
function calculateShapes(\n  updates: TensorInfo, indices: TensorInfo,\n  shape:
number[]): ScatterShapeInfo {\n  // Calculate the number of dimensions in indices\n  const indicesRank =
indices.shape.length;\n  const sliceRank = (indicesRank > 1) ? indices.shape[indicesRank - 1] : 1;\n\n  // Calculate
the number of elements that make up each slice of our updated\n  // tensor. This allows us to work with flattened
tensors and copy over whole\n  // slices at a time.\n  const totalNd = shape.length;\n\n  let sliceSize = 1;\n  for (let i =
sliceRank; i < totalNd; ++i) {\n    sliceSize *= shape[i];\n  }\n\n  const safeSliceDim = (sliceRank < 1) ? 1 :
sliceRank;\n  const numUpdates = sizeFromShape(indices.shape) / safeSliceDim;\n\n  const strides =
[...computeStrides(shape.slice(0, sliceRank), 1)];\n  const outputSize = sizeFromShape(shape);\n  return {sliceRank,
numUpdates, sliceSize, strides, outputSize};\n}\n\n", /**\n * @license\n * Copyright 2017 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n\nimport {TensorInfo} from '../kernel_registry';\nimport * as util from '../util';\n\nexport type SliceInfo = {\n
nonStrided: boolean,\n $begin: number[],\n $end: number[],\n $strides: number[],\n size: number[],\n newShape:
number[],\n outShape: number[]\n};\n\nexport function assertParamsValid(\n  input: TensorInfo, begin: number[],
size: number[]): void {\n  const inputRank = input.shape.length;\n  util.assert(\n
inputRank === begin.length,\n    () => `Error in slice${inputRank}D: Length of begin ${begin} must ` +\n
`match the rank of the array (${inputRank}).`);\n  util.assert(\n
inputRank === size.length,\n    () => `Error in
slice${inputRank}D: Length of size ${size} must ` +\n
`match the rank of the array (${inputRank}).`);\n\n  for (let i = 0; i < inputRank; ++i) {\n    util.assert(\n
begin[i] + size[i] <= input.shape[i],\n    () => `Error in
slice${inputRank}D: begin[${i}] + size[${i}] ` +\n
` (${begin[i] + size[i]}) would overflow input.shape[${i}]
(${input.shape[i]}`);\n  }\n}\n\n/**\n * Converts a binary mask to an array of axes. Used in stridedSlice().\n
*\n * @export\n * function maskToAxes(mask: number): number[] {\n  const axes = [];\n  let axis = 0;\n  while (mask > 0)
{\n    if (mask & 1) {\n      axes.push(axis);\n    }\n    mask /= 2;\n    axis++;\n  }\n  return axes;\n}\n\n/**\n * Computes
the output shape given the strided
slice params. *\n * @export\n * function computeOutShape(\n  begin: number[], end: number[], strides: number[]):
number[] {\n  const size = [];\n  for (let axis = 0; axis < begin.length; axis++) {\n    size[axis] = Math.ceil((end[axis]
- begin[axis]) / strides[axis]);\n  }\n  return size;\n}\n\n// Creates full selection at the elided dimensions. If the
dimension matches\n// the ellipsis mask, override the current stride value. Otherwise, insert.\n\nexport function
stridesWithElidedDims(\n  strides: number[], ellipsisInsertionIndex: number, numElidedAxes: number,\n  inputShape: number[]): number[] {\n  const newStrides = [...strides];\n  for (let i = newStrides.length; i <
inputShape.length; i++) {\n    newStrides.push(1);\n  }\n  for (let i = 0; i < numElidedAxes; i++) {\n    if (i === 0)
{\n      newStrides[ellipsisInsertionIndex] = 1;\n    } else {\n      newStrides.splice(\n
ellipsisInsertionIndex, 0 /*
num elements to delete */,\n      1 /* element to add */);\n    }\n    newStrides.pop();\n  }\n}\n\n

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    }\n }\n return newStrides;\n}\n\nfunction unnormalizeAxis(\n  ellipsisInsertionIndex: number, numElidedAxes:
number,\n  normalizedAxis: number): number {\n  if (normalizedAxis <= ellipsisInsertionIndex) {\n  return
normalizedAxis;\n  }\n}\n\n return normalizedAxis - (numElidedAxes - 1);\n}\n}\n\nfunction
getElidedAxes(numElidedAxes: number, ellipsisInsertionIndex: number) {\n  const elidedAxes = [];\n  for (let i = 0;
i < numElidedAxes; i++) {\n  elidedAxes.push(ellipsisInsertionIndex + i);\n  }\n  return elidedAxes;\n}\n}\n\n//
Normalize the start, end and strides.\n\nexport function getNormalizedAxes(\n  inputShape: number[], ellipsisAxes:
number[], numInterpolatedAxes: number,\n  begin: number[], end: number[], strides: number[], beginMask:
number,\n  endMask: number,\n  ellipsisMask: number): {begin: number[], end: number[], strides: number[]} {\n
const inputRank = inputShape.length;\n  let normalizedBegin = new Array(inputRank),\n  normalizedEnd =
new Array(inputRank),\n  normalizedStrides = new Array(inputRank);\n  if (ellipsisAxes.length &&
numInterpolatedAxes > 0) {\n  const fullIndex = ellipsisAxes[0];\n  // The ellipsis applies to the masked index
as well as any dimensions\n  // that are interpolated.\n  const numElidedAxes = numInterpolatedAxes + 1;\n
normalizedBegin = startIndicesWithElidedDims(\n  beginMask, fullIndex, numElidedAxes, begin,
inputShape);\n  normalizedEnd = stopIndicesWithElidedDims(\n  endMask, fullIndex, numElidedAxes, end,
inputShape);\n  normalizedStrides =\n  stridesWithElidedDims(strides, fullIndex, numElidedAxes,
inputShape);\n  } else {\n  for (let axis = 0; axis < inputRank; axis++) {\n  normalizedBegin[axis] =
startForAxis(\n  beginMask, begin, strides, inputShape, axis, ellipsisMask);\n  normalizedEnd[axis] =\n
stopForAxis(endMask, end, strides, inputShape, axis, ellipsisMask);\n  normalizedStrides[axis] =
stridesForAxis(strides,
axis, ellipsisMask);\n  }\n  }\n}\n\n return {\n  begin: normalizedBegin,\n  end: normalizedEnd,\n  strides:
normalizedStrides\n  };}\n}\n\n// Creates full selection at the elided dimensions. If the dimension matches\n// the
ellipsis mask, override the current start value. Otherwise, insert.\n\nexport function startIndicesWithElidedDims(\n
beginMask: number, ellipsisInsertionIndex: number, numElidedAxes: number,\n  originalBegin: number[],
inputShape: number[]): number[] {\n  const newIndices = [...inputShape];\n  const elidedAxes =
getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n  for (let axis = 0; axis < newIndices.length; axis++) {\n
if (elidedAxes.indexOf(axis) > -1) {\n  newIndices[axis] = 0;\n  } else {\n  const originalAxis =\n
unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n  let originalValue =
originalBegin[originalAxis];\n  if (beginMask & 1 << originalAxis) {\n  originalValue = 0;\n  }\n}\n
newIndices[axis]
= originalValue;\n  }\n  }\n  return newIndices;\n}\n}\n\n// Creates full selection at the elided dimensions. If the
dimension matches\n// the ellipsis mask, override the current stop value. Otherwise, insert.\n\nexport function
stopIndicesWithElidedDims(\n  endMask: number, ellipsisInsertionIndex: number, numElidedAxes: number,\n
originalEnd: number[], inputShape: number[]): number[] {\n  const newIndices = [...inputShape];\n  const
elidedAxes = getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n  for (let axis = 0; axis <
newIndices.length; axis++) {\n  if (elidedAxes.indexOf(axis) > -1) {\n  newIndices[axis] =
Number.MAX_SAFE_INTEGER;\n  } else {\n  const originalAxis =\n
unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n  let originalValue =
originalEnd[originalAxis];\n  if (endMask & 1 << originalAxis) {\n  originalValue =
Number.MAX_SAFE_INTEGER;\n  }\n  newIndices[axis] = originalValue;\n  }\n  }\n}\n}\n\n  for (let i = 0; i < newIndices.length; i++) {\n  // Handle negative indices\n  const axisSize = inputShape[i];\n  if
(newIndices[i] < 0) {\n  newIndices[i] += axisSize;\n  }\n  newIndices[i] = util.clamp(0, newIndices[i],
inputShape[i]);\n  }\n  }\n  return newIndices;\n}\n}\n\nexport function stridesForAxis(\n  strides: number[], axis: number,
ellipsisMask: number): number {\n  let stride = strides[axis];\n  if (ellipsisMask & (1 << axis) || stride == null) {\n
stride = 1;\n  }\n  }\n  return stride;\n}\n}\n\nexport function startForAxis(\n  beginMask: number, startIndices:
number[], strides: number[],\n  inputShape: number[], axis: number, ellipsisMask: number): number {\n  // Begin
with the specified index\n  let start = startIndices[axis];\n  const stride = strides[axis] || 1;\n  // Check the axis bit
from right of masked axes, or the begin index is not set\n  // for the axis.\n  if (beginMask & 1 << axis || ellipsisMask
& 1 << axis || start == null) {\n  if (stride

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> 0) {\n    // Forward iteration - use the first element. These values will get\n    // clamped below (Note: We could
have set them to 0 and axis_size-1, but\n    // use lowest() and max() to maintain symmetry with StopForAxis())\n
start = Number.MIN_SAFE_INTEGER;\n  } else {\n    // Backward iteration - use the last element.\n    start =
Number.MAX_SAFE_INTEGER;\n  }\n}\n\n // Handle negative indices\n const axisSize = inputShape[axis];\n
if (start < 0) {\n  start += axisSize;\n }\n\n // Clamping\n start = util.clamp(0, start, axisSize - 1);\n\n return
start;\n}\n\nexport function stopForAxis(\n  endMask: number, stopIndices: number[], strides: number[],\n  inputShape: number[], axis: number, ellipsisMask: number): number {\n  // Begin with the specified index\n  let stop
= stopIndices[axis];\n  const stride = strides[axis] || 1;\n  // Check the axis bit from right of masked axes, or if the
stop index is not\n  // set for this axis.\n  if (endMask &
(1 << axis) || ellipsisMask & (1 << axis) || stop == null) {\n    if (stride > 0) {\n      // Forward iteration - use the last
element. These values will get\n      // clamped below\n      stop = Number.MAX_SAFE_INTEGER;\n    } else {\n
// Backward iteration - use the first element.\n      stop = Number.MIN_SAFE_INTEGER;\n    }\n  }\n\n // Handle
negative indices\n  const axisSize = inputShape[axis];\n  if (stop < 0) {\n    stop += axisSize;\n  }\n\n // Clamping\n
// Because the end index points one past the last element, we need slightly\n // different clamping ranges depending
on the direction.\n  if (stride > 0) {\n    // Forward iteration\n    stop = util.clamp(0, stop, axisSize);\n  } else {\n
// Backward iteration\n    stop = util.clamp(-1, stop, axisSize - 1);\n  }\n\n  return stop;\n}\n\n/**\n * Returns true if the
slice occupies a continuous set of elements in the\n * 'flat' space.\n */\nexport function isSliceContinuous(\n  shape:
number[], begin: number[], size:
number[]) {\n  // Index of the first axis that has size > 1.\n  let firstNonOneAxis = size.length;\n  for (let i = 0; i <
size.length; i++) {\n    if (size[i] > 1) {\n      firstNonOneAxis = i;\n      break;\n    }\n  }\n\n  for (let i =
firstNonOneAxis + 1; i < size.length; i++) {\n    if (begin[i] > 0 || size[i] !== shape[i]) {\n      return false;\n    }\n
}\n  return true;\n}\n\nexport function computeFlatOffset(begin: number[], strides: number[]): number {\n  let
flatOffset = begin.length > 0 ? begin[begin.length - 1] : 1;\n  for (let i = 0; i < begin.length - 1; i++) {\n    flatOffset
+= begin[i] * strides[i];\n  }\n  return flatOffset;\n}\n\nexport function parseSliceParams(\n  x: TensorInfo, begin:
number|number[], size?: number|number[]) {\n  // The following logic allows for more ergonomic calls.\n  let
begin_: number[];\n  const xRank = x.shape.length;\n  if (typeof begin === 'number') {\n    begin_ = [begin, ...new
Array(xRank - 1).fill(0)];\n  } else if (begin.length <
xRank) {\n    begin_ = begin.concat(new Array(xRank - begin.length).fill(0));\n  } else {\n    begin_ =
begin.slice();\n  }\n  begin_.forEach(d => {\n    util.assert(\n      d !== -1, () => 'slice() does not support negative
begin indexing.);\n  });\n  let size_: number[];\n  if (size == null) {\n    size_ = new Array(xRank).fill(-1);\n  } else
if (typeof size === 'number') {\n    size_ = [size, ...new Array(xRank - 1).fill(-1)];\n  } else if (size.length < xRank)
{\n    size_ = size.concat(new Array(xRank - size.length).fill(-1));\n  } else {\n    size_ = size;\n  }\n  size_ =
size_.map((d, i) => {\n    if (d >= 0) {\n      return d;\n    } else {\n      util.assert(\n        d === -1,\n        () =>
`Negative size values should be exactly -1 but got ` +\n          ` ${d} for the slice() size at index ${i}.`);\n      return
x.shape[i] - begin_[i];\n    }\n  });\n  return [begin_, size_];\n}\n\nexport function sliceInfo(\n  xShape: number[],
begin: number[], end: number[],
strides: number[],\n  beginMask: number, endMask: number, ellipsisMask: number,\n  newAxisMask: number,
shrinkAxisMask: number): SliceInfo {\n  // make a copy because it may be modified further down.\n  let $begin =
begin.slice();\n  let $end = end.slice();\n  let $strides = strides;\n\n  if (strides == null) {\n    $strides = new
Array($begin.length);\n  }\n\n  const ellipsisAxes = maskToAxes(ellipsisMask);\n  if (ellipsisAxes.length > 1) {\n
throw new Error('Multiple ellipses in slice is not allowed.);\n  }\n\n  if (ellipsisMask !== 0 && newAxisMask !==
0) {\n    throw new Error(\n      'Using both ellipsisMask and newAxisMask is not yet supported.);\n  }\n\n  if
(ellipsisMask !== 0 && shrinkAxisMask !== 0) {\n    throw new Error(\n      'Using both ellipsisMask and
shrinkAxisMask is not yet supported.);\n  }\n\n  const numInterpolatedAxes = xShape.length - $begin.length;\n\n //
Expand the dims of x based on the newAxisMask.\n  const expandAxes = maskToAxes(newAxisMask);\n  const newShape =
xShape.slice();\n  expandAxes.forEach(axis => {\n    $begin[axis] = 0;\n    $end[axis] = 1;\n    newShape.splice(axis, 0, 1);\n
});\n\n  const {\n    begin: normalizedBegin,\n    end: normalizedEnd,\n    strides:
normalizedStrides\n  } =\n    getNormalizedAxes(\n      newShape, ellipsisAxes, numInterpolatedAxes, $begin,

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Send, $strides,\n      beginMask, endMask, ellipsisMask);\n $begin = normalizedBegin;\n $end =
normalizedEnd;\n $strides = normalizedStrides;\n\n const shrinkAxes = maskToAxes(shrinkAxisMask);\n //
Adjust the ends based on the shrink mask.\n shrinkAxes.forEach(axis => {\n   $end[axis] = $begin[axis] + 1;\n
$strides[axis] = 1;\n });\n // Figure out the output shape.\n const size = computeOutShape($begin, $end,
$strides);\n // Remove the axes based on shrinkMask.\n const outShape = size.filter((_, axis) =>
shrinkAxes.indexOf(axis) === -1);\n\n const nonStrided = $strides.every(v => v === 1);\n\n return {nonStrided,
$begin,
$end, $strides, size, newShape, outShape};\n}\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {assert} from './util';\n\n/**\n * Types to support JSON-esque data structures internally.\n *\n *
Internally ConfigDict's use camelCase keys and values where the\n * values are class names to be instantiated. On
the python side, these\n * will be snake_case. Internally we allow Enums into the values for better\n * type safety,
but these need to be converted to raw primitives (usually\n * strings) for round-tripping with python.\n *\n *
toConfig returns the TS-friendly representation. model.toJSON() returns\n * the pythonic version as that's the
portable format. If you need to\n * python-ify a non-model level toConfig output, you'll need to use a\n *
convertTsToPythonic from serialization_utils in -Layers.\n *\n * ^\nexport declare type ConfigDictValue =\nboolean | number | string | null | ConfigDictArray | ConfigDict;\nexport declare interface ConfigDict {\n [key:
string]: ConfigDictValue;\n}\nexport declare interface ConfigDictArray extends Array<ConfigDictValue>
{\n\n/**\n * Type to represent the class-type of Serializable objects.\n *\n * Ie the class prototype with access to
the constructor and any\n * static members/methods. Instance methods are not listed here.\n *\n * Source for
this idea: https://stackoverflow.com/a/43607255\n *\nexport declare type SerializableConstructor<T extends
Serializable> = {\n // tslint:disable-next-line:no-any\n new (...args: any[]): T; className: string; fromConfig:
FromConfigMethod<T>;\n};\nexport declare type FromConfigMethod<T extends Serializable> =\n (cls:
SerializableConstructor<T>, config: ConfigDict) => T;\n\n/**\n * Serializable defines the serialization contract.\n
*\n * TFJS requires serializable classes to return their className when asked\n * to avoid issues with
minification.\n *\nexport abstract class Serializable {\n /**\n * Return the class name for this class to use in
serialization contexts.\n *\n * Generally speaking this will be the same thing that constructor.name\n * would
have returned. However, the class name needs to be robust\n * against minification for serialization/deserialization
to work properly.\n *\n * There's also places such as initializers.VarianceScaling, where\n * implementation
details between different languages led to different\n * class hierarchies and a non-leaf node is used for
serialization purposes.\n *\n getClassName(): string {\n   return (this.constructor as
SerializableConstructor<Serializable>).className;\n }\n\n /**\n * Return all the non-weight state needed
to serialize this object.\n *\n abstract getConfig(): ConfigDict;\n\n /**\n * Creates an instance of T from a
ConfigDict.\n *\n * This works for most descendants of serializable. A few need to\n * provide special
handling.\n * @param cls A Constructor for the class to instantiate.\n * @param config The Configuration for the
object.\n *\n /** @nocollapse *\n static fromConfig<T extends Serializable>(\n   cls:
SerializableConstructor<T>, config: ConfigDict): T {\n   return new cls(config);\n }\n}\n\n/**\n * Maps string
keys to class constructors.\n *\n * Used during (de)serialization from the cross-language JSON format, which\n *
requires
the class name in the serialization format matches the class\n * names as used in Python, should it exist.\n
*\nexport class SerializationMap {\n private static instance: SerializationMap;\n classNameMap: {\n
[className: string]:\n   [SerializableConstructor<Serializable>, FromConfigMethod<Serializable>]\n };
\n\n

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private constructor() {\n  this.classNameMap = {};\n } \n\n /**\n  * Returns the singleton instance of the map.\n  *\n  * static getMap(): SerializationMap {\n  if (SerializationMap.instance == null) {\n  SerializationMap.instance
= new SerializationMap();\n  }\n  return SerializationMap.instance;\n } \n\n /**\n  * Registers the class as
serializable.\n  *\n  * static register<T extends Serializable>(cls: SerializableConstructor<T>) {\n
SerializationMap.getMap().classNameMap[cls.className] =\n  [cls, cls.fromConfig];\n } \n\n /**\n  *
Register a class with the serialization map of TensorFlow.js.\n  *\n  * This is often used for registering
custom Layers, so they can be\n  * serialized and deserialized.\n  *\n  * Example:\n  *\n  * ```js\n  * class
MyCustomLayer extends tf.layers.Layer {\n  *   static className = 'MyCustomLayer';\n  *   constructor(config)
{\n  *     super(config);\n  *   }\n  * } \n\n  * tf.serialization.registerClass(MyCustomLayer);\n  * ```\n  *\n  * @param cls
The class to be registered. It must have a public static member\n  *   called `className` defined and the value must
be a non-empty string.\n  *\n  * @doc {heading: 'Models', subheading: 'Serialization', ignoreCI: true}\n  *\n  * export
function registerClass<T extends Serializable>(cls: SerializableConstructor<T>) {\n  assert(\n  cls.className
!= null,\n  () => `Class being registered does not have the static className ` +\n  `property defined.`);\n
assert(\n  typeof cls.className === 'string',\n  () => `className is required to be a string, but got type ` +\n
typeof cls.className);\n  assert(\n  cls.className.length
> 0,\n  () => `Class being registered has an empty-string as its className, ` +\n  `which is disallowed.`);\n\n
SerializationMap.register(cls);\n } \n\n /**\n  * @license\n  * Copyright 2017 Google LLC. All Rights Reserved.\n  *
Licensed under the Apache License, Version 2.0 (the "License");\n  * you may not use this file except in
compliance with the License.\n  * You may obtain a copy of the License at\n  *\n  *
http://www.apache.org/licenses/LICENSE-2.0\n  *\n  * Unless required by applicable law or agreed to in writing,
software\n  * distributed under the License is distributed on an "AS IS" BASIS,\n  * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the License for the specific language
governing permissions and\n  * limitations under the License.\n  *
===== \n
*\n\nimport {ENGINE} from './engine';\nimport {inferShape} from './tensor_util_env';\nimport {RecursiveArray,
TensorLike,
TypedArray} from './types';\nimport {arraysEqual, encodeString, flatten, isString, isTypedArray} from
 './util';\n\nconst TEST_EPSILON_FLOAT32 = 1e-3;\n\nexport const TEST_EPSILON_FLOAT16 = 1e-1;\n\n\nexport
function expectArraysClose(\n  actual: TypedArray|number|RecursiveArray<number>,\n  expected:
TypedArray|number|RecursiveArray<number>, epsilon?: number) {\n  if (epsilon == null) {\n  epsilon =
testEpsilon();\n  }\n  return expectArraysPredicate(\n  actual, expected, (a, b) => areClose(a as number, b as
number, epsilon));\n } \n\n\nexport function testEpsilon() {\n  return ENGINE.backend.floatPrecision() === 32 ?
TEST_EPSILON_FLOAT32 :\n  TEST_EPSILON_FLOAT16;\n } \n\n\nfunction
expectArraysPredicate(\n  actual: TensorLike, expected: TensorLike,\n  predicate: (a: {}, b: {}) => boolean) {\n
let checkClassType = true;\n  if (isTypedArray(actual) || isTypedArray(expected)) {\n  checkClassType = false;\n
}\n  if (isTypedArray(actual)
&& isTypedArray(expected)) {\n  checkClassType = true;\n  }\n  if (checkClassType) {\n  const aType =
actual.constructor.name;\n  const bType = expected.constructor.name;\n\n  if (aType !== bType) {\n  throw
new Error(\n  `Arrays are of different type. Actual: ${aType}. ` +\n  `Expected: ${bType}`);\n  }\n  }\n\n  if (Array.isArray(actual) && Array.isArray(expected)) {\n  const actualShape = inferShape(actual);\n  const
expectedShape = inferShape(expected);\n  if (!arraysEqual(actualShape, expectedShape)) {\n  throw new
Error(\n  `Arrays have different shapes. ` +\n  `Actual: [${actualShape}]. Expected:
[${expectedShape}]`);\n  }\n  }\n\n  const actualFlat =\n  isTypedArray(actual) ? actual : flatten(actual as
RecursiveArray<number>);\n  const expectedFlat = isTypedArray(expected) ?\n  expected :\n  flatten(expected
as RecursiveArray<number>);\n\n  if (actualFlat.length !== expectedFlat.length) {\n  throw
new Error(\n  `Arrays have different lengths actual: ${actualFlat.length} vs ` +\n  `expected:
${expectedFlat.length}.\\n` +\n  `Actual: [${actualFlat}].\\n` +\n  `Expected: [${expectedFlat}].`);\n  }\n  for
(let i = 0; i < expectedFlat.length; ++i) {\n  const a = actualFlat[i];\n  const e = expectedFlat[i];\n\n  if

```



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(env().getBool('DEPRECATION_WARNINGS_ENABLED')) {\n  console.warn(\n    msg + ' You can disable
deprecation warnings with '+\n    'tf.disableDeprecationWarnings().');\n
}\n}\nsetDeprecationWarningFn(deprecationWarn);\n\n/**\n * Dispose all variables kept in backend engine.\n *\n *
@doc {heading: 'Environment'}\n */\nexport function disposeVariables(): void {\n
ENGINE.disposeVariables();\n}\n\n/**\n * It returns the global engine that keeps track of all tensors and
backends.\n *\n * @doc {heading: 'Environment'}\n */\nexport function engine(): Engine {\n  return
ENGINE;\n}\n\n/**\n * Returns memory
info at the current time in the program. The result is an\n * object with the following properties:\n *\n * -
`numBytes`: Number of bytes allocated (undisposed) at this time.\n * - `numTensors`: Number of unique tensors
allocated.\n * - `numDataBuffers`: Number of unique data buffers allocated\n * (undisposed) at this time, which is
the number of tensors\n * (e.g. `a.reshape(newShape)` makes a new Tensor that shares the same\n * data buffer
with `a`).\n * - `unreliable`: True if the memory usage is unreliable. See `reasons` when\n * `unreliable` is true.\n *
- `reasons`: `string[]`, reasons why the memory is unreliable, present if\n * `unreliable` is true.\n *\n * WebGL
Properties:\n * - `numBytesInGPU`: Number of bytes allocated (undisposed) in the GPU only at\n * this time.\n
*\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\nexport function memory(): MemoryInfo {\n
return ENGINE.memory();\n}\n\n/**\n * Executes the provided function `f` and returns
a promise that resolves\n * with information about the function's memory use:\n *\n * - `newBytes`: the number of new
bytes allocated\n * - `newTensors`: the number of new tensors created\n * - `peakBytes`: the peak number of bytes
allocated\n * - `kernels`: an array of objects for each kernel involved that reports\n * their input and output shapes,
number of bytes used, and number of new\n * tensors created.\n * - `kernelNames`: an array of unique strings with
just the names of the\n * kernels in the `kernels` array.\n *\n * ```js\n * const profile = await tf.profile() => {\n *
const x = tf.tensor1d([1, 2, 3]);\n * let x2 = x.square();\n * x2.dispose();\n * x2 = x.square();\n * x2.dispose();\n
* return x;\n * };\n * console.log(`newBytes: ${profile.newBytes}`);\n * console.log(`newTensors:
${profile.newTensors}`);\n * console.log(`byte usage over all kernels: ${profile.kernels.map(k =>\n *
k.totalBytesSnapshot)`});\n * ```\n *\n * @doc {heading: 'Performance', subheading:
'Profile'}\n */\nexport function profile(f: () => (TensorContainer | Promise<TensorContainer>)):\n
Promise<ProfileInfo> {\n  return ENGINE.profile(f);\n}\n\n/**\n * Executes the provided function `fn` and after it
is executed, cleans up all\n * intermediate tensors allocated by `fn` except those returned by `fn`. \n * `fn` must not
return a Promise (async functions not allowed). The returned\n * result can be a complex object.\n *\n * Using this
method helps avoid memory leaks. In general, wrap calls to\n * operations in `tf.tidy` for automatic memory
cleanup.\n *\n * NOTE: Variables do *not* get cleaned up when inside a tidy(). If you want to\n * dispose variables,
please use `tf.disposeVariables` or call `dispose()`\n * directly on variables.\n *\n * ```js\n * // y = 2 ^ 2 + 1\n * const
y = tf.tidy(() => {\n * // a, b, and one will be cleaned up when the tidy ends.\n * const one = tf.scalar(1);\n *
const a = tf.scalar(2);\n * const b = a.square();\n *\n * console.log(`numTensors
(in tidy): ' + tf.memory().numTensors);\n *\n * // The value returned inside the tidy function will return\n * //
through the tidy, in this case to the variable y.\n * return b.add(one);\n * });\n *\n * console.log(`numTensors
(outside tidy): ' + tf.memory().numTensors);\n * y.print();\n * ```\n *\n * @param nameOrFn The name of the
closure, or the function to execute.\n * If a name is provided, the 2nd argument should be the function.\n * If
debug mode is on, the timing and the memory usage of the function\n * will be tracked and displayed on the
console using the provided name.\n * @param fn The function to execute.\n *\n * @doc {heading: 'Performance',
subheading: 'Memory'}\n */\nexport function tidy<T extends TensorContainer>(\n  nameOrFn: string|ScopeFn<T>,\n
fn?: ScopeFn<T>): T {\n  return ENGINE.tidy(nameOrFn, fn);\n}\n\n/**\n * Disposes any `tf.Tensor`'s found within
the provided object.\n *\n * @param container an object that may be a `tf.Tensor`
or may directly\n * contain `tf.Tensor`'s, such as a `Tensor[]` or `{key: Tensor, ...}`. If\n * the object is not a
`tf.Tensor` or does not contain `Tensors`, nothing\n * happens. In general it is safe to pass any object here, except
that\n * `Promise`'s are not supported.\n *\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\nexport
function dispose(container: TensorContainer) {\n  const tensors = getTensorsInContainer(container);\n
tensors.forEach(tensor => tensor.dispose());\n}\n\n/**\n * Keeps a `tf.Tensor` generated inside a `tf.tidy` from being

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disposed\n * automatically.\n *\n * ```js\n * let b;\n * const y = tf.tidy(() => {\n *   const one = tf.scalar(1);\n *   const a = tf.scalar(2);\n *   // b will not be cleaned up by the tidy. a and one will be cleaned up\n *   // when the tidy ends.\n *   b = tf.keep(a.square());\n *   console.log('numTensors (in tidy): ' + tf.memory().numTensors);\n *   // The value returned inside the tidy function\n *   will return\n *   // through the tidy, in this case to the variable y.\n *   return b.add(one);\n * });\n *\n * console.log('numTensors (outside tidy): ' + tf.memory().numTensors);\n * console.log('y:');\n * y.print();\n * console.log('b:');\n * b.print();\n * ```\n *\n * @param result The tensor to keep from being disposed.\n *\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\n\nexport function keep<T extends Tensor>(result: T): T {\n  return ENGINE.keep(result);\n}\n\n/**\n * Executes `f()` and returns a promise that resolves with timing\n * information.\n *\n * The result is an object with the following properties:\n *\n * - `wallMs`: Wall execution time.\n *\n * - `kernelMs`: Kernel execution time, ignoring data transfer. If using the\n *   WebGL backend and the query timer extension is not available, this will\n *   return an error object.\n *\n * - On `WebGL` The following additional properties exist:\n *\n *   - `uploadWaitMs`: CPU blocking time on texture uploads.\n *\n *   - `downloadWaitMs`: CPU blocking time on texture downloads (readPixels).\n *\n * ```js\n * const x = tf.randomNormal([20, 20]);\n * const time = await tf.time(() => x.matMul(x));\n * console.log(`kernelMs: ${time.kernelMs}, wallTimeMs: ${time.wallMs}`);\n * ```\n *\n * @param f The function to execute and time.\n *\n * @doc {heading: 'Performance', subheading: 'Timing'}\n */\n\nexport function time(f: () => void): Promise<TimingInfo> {\n  return ENGINE.time(f);\n}\n\n/**\n * Sets the backend (cpu, webgl, wasm, etc) responsible for creating tensors and\n * executing operations on those tensors. Returns a promise that resolves\n * to a boolean if the backend initialization was successful.\n *\n * Note this disposes the current backend, if any, as well as any tensors\n * associated with it. A new backend is initialized, even if it is of the\n * same type as the previous one.\n *\n * @param backendName The name of the backend. Currently supports\n *   `webgl`|`cpu` in the browser, `tensorflow` under node.js\n *   (requires tfjs-node), and `wasm` (requires tfjs-backend-wasm).\n *\n * @doc {heading: 'Backends'}\n */\n\nexport function setBackend(backendName: string): Promise<boolean> {\n  return ENGINE.setBackend(backendName);\n}\n\n/**\n * Returns a promise that resolves when the currently selected backend (or the\n * highest priority one) has initialized. Await this promise when you are using\n * a backend that has async initialization.\n *\n * @doc {heading: 'Backends'}\n */\n\nexport function ready(): Promise<void> {\n  return ENGINE.ready();\n}\n\n/**\n * Returns the current backend name (cpu, webgl, etc). The backend is\n * responsible for creating tensors and executing operations on those tensors.\n *\n * @doc {heading: 'Backends'}\n */\n\nexport function getBackend(): string {\n  return ENGINE.backendName;\n}\n\n/**\n * Removes a backend and the registered factory.\n *\n * @doc {heading: 'Backends'}\n */\n\nexport function removeBackend(name: string): void {\n  ENGINE.removeBackend(name);\n}\n\n/**\n * Finds the backend registered under the provided name. Returns null if the\n * name is not in the registry, or the registration hasn't finished yet.\n *\n * @doc {heading: 'Backends'}\n */\n\nexport function findBackend(name: string): KernelBackend | null {\n  return ENGINE.findBackend(name);\n}\n\n/**\n * Finds the backend factory registered under the provided name. Returns a\n * function that produces a new backend when called. Returns null if the name\n * is not in the registry.\n *\n * @doc {heading: 'Backends'}\n */\n\nexport function findBackendFactory(name: string): () => KernelBackend | Promise<KernelBackend> {\n  return ENGINE.findBackendFactory(name);\n}\n\n/**\n * Registers a global backend. The registration should happen when importing\n * a module file (e.g. when importing `backend_webgl.ts`), and is used for\n * modular builds (e.g. custom tfjs bundle with only webgl support).\n *\n * @param factory The backend factory function. When called, it should\n *   return a backend instance, or a promise of an instance.\n *\n * @param priority The priority of the backend (higher = more important).\n *   In case multiple backends are registered, the priority is used to find\n *   the best backend. Defaults to 1.\n *\n * @return False if there is already a registered backend under this name, true\n *   if not.\n *\n * @doc {heading: 'Backends'}\n */\n\nexport function registerBackend(\n  name: string,\n  factory: () => KernelBackend | Promise<KernelBackend>,\n  priority = 1): boolean {\n  return ENGINE.registerBackend(name, factory, priority);\n}\n\n/**\n * Gets the current backend. If no backends have been initialized, this will\n * attempt to initialize the best backend. Will throw an error if the\n * highest priority backend has async initialization, in which case, you should call\n * 'await tf.ready()' before

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running other code.\n *\n * @doc {heading: 'Backends'}\n *\nexport function backend(): KernelBackend {\n return
ENGINE.backend;\n}\n\n/**\n * Sets the global platform.\n *\n * @param platformName The
name of this platform.\n * @param platform A platform implementation.\n *\nexport function
setPlatform(platformName: string, platform: Platform) {\n env().setPlatform(platformName, platform);\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {ENGINE} from './engine';\nimport {Add, AddInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{op} from './operation';\n\n/**\n * Adds two `tf.Tensor`s element-wise, A + B. Supports broadcasting.\n *\n *\n *
`js\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.tensor1d([10, 20, 30, 40]);\n *\n * a.add(b).print(); // or
tf.add(a, b)\n * ``\n *\n * ``js\n * // Broadcast add a with b.\n * const a = tf.scalar(5);\n * const b = tf.tensor1d([10,
20, 30, 40]);\n *\n * a.add(b).print(); // or tf.add(a, b)\n * ``\n *\n * @param a The first `tf.Tensor` to add.\n * @param
b The second `tf.Tensor` to add. Must have the same type as `a`.\n *\n * @doc {heading: 'Operations', subheading:
'Arithmetic'}\n *\nfunction add_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =
convertToTensor(a, 'a', 'add');\n let $b =
convertToTensor(b, 'b', 'add');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: AddInputs = {a: $a, b:
$b};\n\n return ENGINE.runKernel(Add, inputs as {} as NamedTensorMap);\n}\n\nexport const add =
op({add_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====
*\n\nimport {ENGINE} from './engine';\nimport {FloorDiv,
FloorDivInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Divides two
`tf.Tensor`s element-wise, A / B. Supports broadcasting.\n * The result is rounded with floor function.\n *\n *\n *
`js\n * const a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n *\n * a.floorDiv(b).print(); // or
tf.div(a, b)\n * ``\n *\n * ``js\n * // Broadcast div a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b =
tf.scalar(2);\n *\n * a.floorDiv(b).print(); // or tf.floorDiv(a, b)\n * ``\n *\n * @param a The first tensor as the
numerator.\n * @param b The second tensor as the denominator. Must have the same dtype as\n * `a`.\n *\n * @doc
{heading: 'Operations', subheading: 'Arithmetic'}\n *\nfunction floorDiv_<T extends
Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'floorDiv');\n let
$b = convertToTensor(b, 'b', 'floorDiv');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: FloorDivInputs =
{a: $a, b: $b};\n\n return ENGINE.runKernel(FloorDiv, inputs as {} as NamedTensorMap);\n}\n\nexport const
floorDiv = op({floorDiv_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n*\n\nimport {ENGINE} from './engine';\nimport {RealDiv, RealDivInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {floorDiv} from './floorDiv';\nimport {op} from './operation';\n\n/**\n * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting.\n *\n * const a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n *\n * a.div(b).print(); // or tf.div(a, b)\n *\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(2);\n *\n * a.div(b).print(); // or tf.div(a, b)\n *\n * @param a The first tensor as the numerator.\n * @param b The second tensor as the denominator. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction div_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'div');\n  let $b = convertToTensor(b, 'b', 'div');\n  [$a, $b] = makeTypesMatch($a, $b);\n  if ($a.dtype === 'int32' && $b.dtype === 'int32') {\n    return floorDiv($a, $b);\n  }\n  const inputs: RealDivInputs = {a: $a, b: $b};\n  const attrs = {};\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  return ENGINE.runKernel(RealDiv, inputs as {} as NamedTensorMap, attrs) as T;\n}\n\nexport const div = op({div_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport {ENGINE} from './engine';\nimport {Multiply, MultiplyInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Multiplies two `tf.Tensor`s element-wise, A * B. Supports broadcasting.\n *\n * We also expose `tf.mulStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the same shape (does not broadcast).\n *\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.tensor1d([2, 3, 4, 5]);\n *\n * a.mul(b).print(); // or tf.mul(a, b)\n *\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.scalar(5);\n *\n * a.mul(b).print(); // or tf.mul(a, b)\n *\n * @param a The first tensor to multiply.\n * @param b The second tensor to multiply. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction mul_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'mul');\n  let $b = convertToTensor(b, 'b', 'mul');\n  [$a, $b] = makeTypesMatch($a, $b);\n  const inputs: MultiplyInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(Multiply, inputs as {} as NamedTensorMap);\n}\n\nexport const mul = op({mul_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport {ENGINE} from './engine';\nimport {Abs, AbsInputs, ComplexAbs, ComplexAbsInputs} from
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../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport
{convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from
../operation';\n\n/**\n * Computes absolute value element-wise: `abs(x)`\n * \n * ```\n * const x = tf.tensor1d([-1, 2,
-3,
4]);\n * \n * x.abs().print(); // or tf.abs(x)\n * ```\n * @param x The input `tf.Tensor`.\n * \n * @doc {heading:
'Operations', subheading: 'Basic math'}\n * \nfunction abs_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
convertToTensor(x, 'x', 'abs');\n  \n  if ($x.dtype === 'complex64') {\n    const inputs: ComplexAbsInputs = {x: $x};\n
return ENGINE.runKernel(ComplexAbs, inputs as {} as NamedTensorMap);\n  } else {\n    const inputs:
AbsInputs = {x: $x};\n    return ENGINE.runKernel(Abs, inputs as {} as NamedTensorMap);\n  }\n}\n\nexport
const abs = op({abs_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====\n
*\nimport {ENGINE} from '../engine';\nimport {Acos, AcosInputs} from '../kernel_names';\nimport {Tensor} from
../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from ../operation';\n\n/**\n * Computes
acos of the input `tf.Tensor` element-wise: `acos(x)`\n * \n * ```\n * const x = tf.tensor1d([0, 1, -1, .7]);\n * \n *
x.acos().print(); // or tf.acos(x)\n * ```\n * @param x The input tensor.\n * \n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n * \nfunction acos_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
convertToTensor(x, 'x', 'acos');\n  \n  const inputs:
AcosInputs = {x: $x};\n  \n  return ENGINE.runKernel(Acos, inputs as {} as NamedTensorMap);\n}\n\nexport const
acos = op({acos_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {Acosh, AcoshInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap}
from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
../types';\n\nimport {op} from ../operation';\n\n/**\n * Computes the inverse hyperbolic cos of the input `tf.Tensor`
element-wise:\n * `acosh(x)`\n * \n * ```\n * const x = tf.tensor1d([10, 1, 3, 5.7]);\n * \n * x.acosh().print(); // or
tf.acosh(x)\n * ```\n * @param x The input tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
*\nfunction acosh_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'acosh');\n
  \n  const inputs: AcoshInputs = {x: $x};\n  \n  return ENGINE.runKernel(Acosh, inputs as {} as
NamedTensorMap);\n}\n\nexport const acosh = op({acosh_});\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under

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the License.\n *

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=====\n
*\nimport {ENGINE} from './engine';\nimport {AddN, AddNInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from
'./operation';\n\n/**\n * Adds a list of `tf.Tensor`'s element-wise, each with the same shape and dtype.\n * \n * ```\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * \n * tf.addN([a,
b, c]).print();\n * ```\n * @param tensors A list of tensors with the same shape and dtype.\n * @doc {heading:
'Operations', subheading: 'Arithmetic'}\n *\nfunction addN_<T extends Tensor>(tensors: Array<T|TensorLike>): T
{\n  util.assert(\n    Array.isArray(tensors),\n    () => "The argument passed to tf.addN() must be a list of
tensors");\n  util.assert(\n    tensors.length >= 1,\n    () => `Must pass at least one tensor to tf.addN(), but got ` +\n
    `${tensors.length}`);\n\n  const $tensors =\n    tensors.map((t, i) => convertToTensor(t, `tensors${i}`),
'addN');\n\n  const firstTensor = $tensors[0];\n  $tensors.forEach(t => {\n    if (t.dtype !== firstTensor.dtype) {\n
throw new Error(\n      'All tensors passed to tf.addN() must have the same dtype');\n    }\n  });\n\n  $tensors.forEach(t => {\n    if (!util.arraysEqual(t.shape, firstTensor.shape)) {\n    throw new Error(\n      'All
tensors passed to tf.addN() must have the same shape');\n    }\n  });\n\n  const inputs: AddNInputs = $tensors;\n  return ENGINE.runKernel(AddN, inputs as {} as
NamedTensorMap);\n}\n\nexport const addN = op({addN_});\n\n",/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*\nimport {ENGINE} from './engine';\nimport {All, AllAttrs, AllInputs} from './kernel_names';\nimport
{NamedAttrMap}
from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes the logical and of elements across dimensions of a
`tf.Tensor`.\n * \n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank
of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are
retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single
element is returned.\n * \n * ```\n * const x = tf.tensor1d([1, 1, 1], 'bool');\n * \n * x.all().print(); // or tf.all(x)\n *
```\n * \n * ```\n * const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n * \n * const axis = 1;\n * \n * x.all(axis).print(); // or
tf.all(x, axis)\n * ```\n * @param x The input tensor. Must be of dtype bool.\n
* @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param keepDims If
true, retains reduced dimensions with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n
*\nfunction all_<T extends Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T
{\n const $x = convertToTensor(x, 'x', 'all', 'bool');\n\n const inputs: AllInputs = {x: $x};\n const attrs: AllAttrs =
{axis, keepDims};\n\n return ENGINE.runKernel(\n All, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap);\n}\n\nexport const all = op({all_});\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
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permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Any, AnyAttrs, AnyInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes the logical or of elements across dimensions of a\n * `tf.Tensor`.\n * \n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single element is returned.\n * \n * `const x = tf.tensor1d([1, 1, 1], 'bool');\n * x.any().print(); // or tf.any(x)\n * `const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n * const axis = 1;\n * x.any(axis).print(); // or tf.any(x, axis)\n * `@param x The input tensor. Must be of dtype bool.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction any_<T extends Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const $x = convertToTensor(x, 'x', 'any', 'bool');\n const inputs: AnyInputs = {x: $x};\n const attrs: AnyAttrs = {axis, keepDims};\n return ENGINE.runKernel(\n Any, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\n// tslint:disable-next-line:variable-name\nexport const any = op({any_});\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns the indices of the maximum values along an `axis`.\n * \n * The result has the same shape as `input` with the dimension along\n * `axis` removed.\n * \n * `const x = tf.tensor1d([1, 2, 3]);\n * x.argmax().print(); // or tf.argmax(x)\n * `const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n * const axis = 1;\n * x.argmax(axis).print(); // or tf.argmax(x, axis)\n * `@param x The input tensor.\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction argMax_<T extends Tensor>(\n x: Tensor|TensorLike, axis = 0): T {\n const $x = convertToTensor(x, 'x', 'argMax');\n const inputs: ArgMaxInputs = {x: $x};\n const attrs: ArgMaxAttrs = {axis};\n return ENGINE.runKernel(\n ArgMax, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMax = op({argMax_});\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {ArgMin, ArgMinAttrs, ArgMinInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns the indices of the minimum values along an `axis`.\n * \n * The result has the same shape as `input` with the dimension along\n * `axis` removed.\n * \n * `const x = tf.tensor1d([1, 2, 3]);\n * x.argmin().print(); // or tf.argmin(x)\n * `const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n * const axis = 1;\n * x.argmin(axis).print(); // or tf.argmin(x, axis)\n * `@param x The input tensor.\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction argMin_<T extends Tensor>(\n x: Tensor|TensorLike, axis = 0): T {\n const $x = convertToTensor(x, 'x', 'argMin');\n const inputs: ArgMinInputs = {x: $x};\n const attrs: ArgMinAttrs = {axis};\n return ENGINE.runKernel(\n ArgMin, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMin = op({argMin_});\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {ArgMin, ArgMinAttrs, ArgMinInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns the indices of the minimum values along an `axis`.\n * \n * The result has the same shape as `input` with the dimension along\n * `axis` removed.\n * \n * `const x = tf.tensor1d([1, 2, 3]);\n * x.argmin().print(); // or tf.argmin(x)\n * `const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n * const axis = 1;\n * x.argmin(axis).print(); // or tf.argmin(x, axis)\n * `@param x The input tensor.\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction argMin_<T extends Tensor>(\n x: Tensor|TensorLike, axis = 0): T {\n const $x = convertToTensor(x, 'x', 'argMin');\n const inputs: ArgMinInputs = {x: $x};\n const attrs: ArgMinAttrs = {axis};\n return ENGINE.runKernel(\n ArgMin, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMin = op({argMin_});\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns the indices of the maximum values along an `axis`.\n * \n * The result has the same shape as `input` with the dimension along\n * `axis` removed.\n * \n * `const x = tf.tensor1d([1, 2, 3]);\n * x.argmax().print(); // or tf.argmax(x)\n * `const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n * const axis = 1;\n * x.argmax(axis).print(); // or tf.argmax(x, axis)\n * `@param x The input tensor.\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction argMax_<T extends Tensor>(\n x: Tensor|TensorLike, axis = 0): T {\n const $x = convertToTensor(x, 'x', 'argMax');\n const inputs: ArgMaxInputs = {x: $x};\n const attrs: ArgMaxAttrs = {axis};\n return ENGINE.runKernel(\n ArgMax, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMax = op({argMax_});\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {ArgMin, ArgMinAttrs, ArgMinInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns the indices of the minimum values along an `axis`.\n * \n * The result has the same shape as `input` with the dimension along\n * `axis` removed.\n * \n * `const x = tf.tensor1d([1, 2, 3]);\n * x.argmin().print(); // or tf.argmin(x)\n * `const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n * const axis = 1;\n * x.argmin(axis).print(); // or tf.argmin(x, axis)\n * `@param x The input tensor.\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction argMin_<T extends Tensor>(\n x: Tensor|TensorLike, axis = 0): T {\n const $x = convertToTensor(x, 'x', 'argMin');\n const inputs: ArgMinInputs = {x: $x};\n const attrs: ArgMinAttrs = {axis};\n return ENGINE.runKernel(\n ArgMin, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMin = op({argMin_});\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====
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{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\n\nimport {op} from './operation';\n\n/**\n * Returns the indices of the minimum values along an `axis`.\n *
 * The result has the same shape as `input` with the dimension along `axis`\n * removed.\n *
 * ``js\n * const x
 = tf.tensor1d([1, 2, 3]);\n * x.argMin().print(); // or tf.argMin(x)\n * ``\n *
 * ``js\n * const x = tf.tensor2d([1,
 2, 4, 3], [2, 2]);\n * const axis = 1;\n * x.argMin(axis).print(); // or tf.argMin(x, axis)\n * ``\n *
 * @param x
 The input tensor.\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n *
 * @doc
 {heading: 'Operations', subheading: 'Reduction'}\n\nfunction argMin_<T extends Tensor>(x: Tensor|TensorLike,
 axis = 0): T {\n const $x = convertToTensor(x, 'x', 'argMin');\n const inputs:
 ArgMinInputs = {x: $x};\n const attrs: ArgMinMaxAttrs = {axis};\n return ENGINE.runKernel(\n ArgMin,
 inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMin =
op({argMin_});\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
 Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n *
 * http://www.apache.org/licenses/LICENSE-2.0\n *
 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *

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*\n\nimport {ENGINE} from './engine';\nimport {Asin, AsinInputs}
 from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\n\nimport {op} from './operation';\n\n/**\n * Computes asin of the input `tf.Tensor` element-wise:
 `asin(x)`\n *
 * ``js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n * x.asin().print(); // or tf.asin(x)\n * ``\n *
 * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n\nfunction asin_<T
 extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'asin');\n const inputs: AsinInputs =
 {x: $x};\n return ENGINE.runKernel(Asin, inputs as {} as NamedTensorMap);\n}\n\nexport const asin =
op({asin_});\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
 Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy
 of the License at\n *
 * http://www.apache.org/licenses/LICENSE-2.0\n *
 * Unless required by applicable law or
 agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {ENGINE} from './engine';\nimport {Asinh, AsinhInputs} from './kernel_names';\nimport {Tensor}
 from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
 inverse hyperbolic sin of the input `tf.Tensor` element-wise:\n * `asinh(x)`\n *
 * ``js\n * const x = tf.tensor1d([0,
 1, -1, .7]);\n * x.asinh().print(); // or tf.asinh(x)\n * ``\n *
 * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n\nfunction
 asinh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'asinh');\n const inputs:
 AsinhInputs = {x: $x};\n return ENGINE.runKernel(Asinh, inputs as {} as NamedTensorMap);\n}\n\nexport const
 asinh = op({asinh_});\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
 under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n *
 * http://www.apache.org/licenses/LICENSE-2.0\n *
 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

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implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Atan, AtanInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes atan of the input `tf.Tensor` element-wise: `atan(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n *\n * x.atan().print(); // or tf.atan(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction atan_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'atan');\n\n const inputs: AtanInputs = {x: $x};\n\n return ENGINE.runKernel(Atan, inputs as { } as NamedTensorMap);\n}\n\nexport const atan = op({atan_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
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=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Atan2, Atan2Inputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes arctangent of `tf.Tensor`s a / b element-wise: `atan2(a, b)`\n *\n * Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1.0, 1.0, -1.0, .7]);\n *\n * const b = tf.tensor1d([2.0, 13.0, 3.5, .21]);\n *\n * tf.atan2(a, b).print()\n *\n * @param a The first tensor.\n * @param b The second tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction atan2_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'atan2');\n let $b = convertToTensor(b, 'b', 'atan2');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: Atan2Inputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Atan2, inputs as { } as NamedTensorMap);\n}\n\nexport const atan2 = op({atan2_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
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=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Atanh, AtanhInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes inverse hyperbolic tan of the input `tf.Tensor` element-wise:\n *\n * ```js\n * const x = tf.tensor1d([0, .1, -.1, .7]);\n *\n * x.atanh().print();\n *\n * // or tf.atanh(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction atanh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'atanh');\n\n const inputs: AtanhInputs = {x: $x};\n\n return ENGINE.runKernel(Atanh, inputs as { } as NamedTensorMap);\n}\n\nexport const atanh = op({atanh_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
```

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations  
under the License.\n \*

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=====\n*\n\ntype PadType = 'SAME'|'VALID'|'NUMBER'|'EXPLICIT';\n\n// For NHWC should be in the following
form:\n// [[0, 0], [pad_top,pad_bottom], [pad_left, pad_right], [0, 0]]\n// For NCHW should be in the following
form:\n// [[0, 0], [0, 0], [pad_top,pad_bottom], [pad_left, pad_right]]\n// Reference:
https://www.tensorflow.org/api_docs/python/tf/nn/conv2d\n\nexport type ExplicitPadding =\n [[number, number],
 [number, number], [number, number], [number, number]];\n\nexport type PadInfo = {\n top: number,\n left:
number,\n right: number,\n bottom: number,\n type: PadType\n};\n\nexport type PadInfo3D = {\n top: number,\n left: number,\n right: number,\n bottom: number,\n front: number,\n back: number,\n type: PadType\n};\n\n/**\n * Information about the forward pass of a convolution/pooling operation.\n * It includes input and output shape,
strides, filter size and padding\n * information.\n */\nexport type Conv2DInfo = {\n batchSize: number,\n inHeight: number,\n inWidth: number,\n inChannels: number,\n outHeight: number,\n outWidth: number,\n outChannels: number,\n dataFormat:
'channelsFirst'|'channelsLast',\n strideHeight: number,\n strideWidth: number,\n dilationHeight: number,\n dilationWidth: number,\n filterHeight: number,\n filterWidth: number,\n effectiveFilterHeight: number,\n effectiveFilterWidth: number,\n padInfo: PadInfo,\n inShape: [number, number, number, number],\n outShape:
[number, number, number, number],\n filterShape: [number, number, number, number]\n};\n\n/**\n * @param inputShape Input tensor shape is of the following dimensions:\n * `[batch, height, width, inChannels]`.\n * @param filterShape The filter shape is of the following dimensions:\n * `[filterHeight, filterWidth, depth]`.\n * @param strides The strides of the sliding window for each dimension of the\n * input tensor: `[strideHeight,
strideWidth]`.\n * If `strides` is a single number,\n * then `strideHeight == strideWidth`.\n * @param pad The type of padding
algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * -
`valid`: output will be smaller than input if filter is larger\n * than 1*1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution]\n */\n\nhttps://www.tensorflow.org/api_guides/python/nn#Convolution\n\n/**\n * @param dataFormat The data format of the
input and output data.\n * Defaults to 'NHWC'.
 * @param dilations The dilation rates: `[dilationHeight,
dilationWidth]`.\n * Defaults to `[1, 1]`. If `dilations` is a single number, then\n * `dilationHeight ==
dilationWidth`.\n */\n\nexport function computeDilation2DInfo(\n inputShape: [number, number, number,
number],\n filterShape: [number, number, number],\n strides: number|[number, number],\n pad:
'same'|'valid'|number,
dataFormat: 'NHWC' = 'NHWC',\n dilations: number|[number, number]) {\n // `computeConv2DInfo` require
filterShape to be in the dimension of:\n // `[filterHeight, filterWidth, depth, outDepth]`,
dilation2d doesn't have\n outDepth, it should have the same depth as the input.\n // Input shape: [batch, height, width, inChannels]\n const inputChannels = inputShape[3];\n const $filterShape =\n [...filterShape, inputChannels] as [number, number,
number, number];\n const $dataFormat = convertConv2DDataFormat(dataFormat);\n\n return
computeConv2DInfo(\n inputShape, $filterShape, strides, dilations, pad,\n null /* roundingMode */, null /*
depthWise */, $dataFormat);\n}\n\nexport function computePool2DInfo(\n inShape: [number, number, number,
number],\n filterSize: [number, number]|number,\n strides: number|[number, number],\n dilations:
number|[number, number],\n pad: 'same'|'valid'|number,\n roundingMode?: 'floor'|'round'|'ceil',\n dataFormat:
'channelsFirst'|'channelsLast' = 'channelsLast'): Conv2DInfo {\n const [filterHeight, filterWidth] =
parseTupleParam(filterSize);\n let filterShape: [number, number, number, number];\n if (dataFormat ===
'channelsLast') {\n filterShape = [filterHeight, filterWidth, inShape[3], inShape[3]];\n } else if (dataFormat ===
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'channelsFirst') {\n filterShape = [filterHeight, filterWidth, inShape[1], inShape[1]]; \n } else {\n throw new\n Error(`Unknown dataFormat ${dataFormat}`); \n } \n\n return computeConv2DInfo(\n inShape, filterShape,\n strides, dilations, pad, roundingMode, false, \n dataFormat); \n} \n\n** \n * Computes the information for a\n forward pass of a pooling3D operation. \n */ \nexport function computePool3DInfo(\n inShape: [number, number,\n number, number, number], \n filterSize: number|[number, number, number], \n strides: number|[number, number,\n number], \n dilations: number|[number, number, number], \n pad: 'same'|'valid'|number, \n roundingMode?:\n 'floor'|'round'|'ceil', \n dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): Conv3DInfo {\n const [filterDepth,\n filterHeight, filterWidth] = parse3TupleParam(filterSize); \n\n let filterShape: [number, number, number, number,\n number]; \n\n let $dataFormat: 'channelsFirst'|'channelsLast'; \n\n if (dataFormat === 'NDHWC') {\n $dataFormat =\n 'channelsLast'; \n\n filterShape = \n [filterDepth, filterHeight, filterWidth, inShape[4], inShape[4]]; \n\n } else if\n (dataFormat === 'NCDHW') {\n $dataFormat = 'channelsFirst'; \n\n filterShape = \n [filterDepth, filterHeight,\n filterWidth, inShape[1], inShape[1]]; \n\n } else {\n throw new Error(`Unknown dataFormat ${dataFormat}`); \n\n } \n\n return computeConv3DInfo(\n inShape, filterShape, strides, dilations, pad, false, $dataFormat, \n roundingMode); \n} \n\n** \n * Computes the information for a forward pass of a convolution/pooling \n * operation. \n */ \nexport function computeConv2DInfo(\n inShape: [number, number, number, number], \n filterShape: [number, number, number, number], \n strides: number|[number, number], \n dilations:\n number|[number, number], \n pad: 'same'|'valid'|number|ExplicitPadding, \n roundingMode?: 'floor'|'round'|'ceil',\n depthwise = false, \n dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast'): Conv2DInfo {\n let [batchSize,\n inHeight, inWidth, inChannels] = [-1, -1, -1, -1]; \n\n if (dataFormat === 'channelsLast') {\n [batchSize, inHeight,\n inWidth, inChannels] = inShape; \n\n } else if (dataFormat === 'channelsFirst') {\n [batchSize, inChannels,\n inHeight, inWidth] = inShape; \n\n } else {\n throw new Error(`Unknown dataFormat ${dataFormat}`); \n\n } \n\n const [filterHeight, filterWidth, , filterChannels] = filterShape; \n\n const [strideHeight, strideWidth] =\n parseTupleParam(strides); \n\n const [dilationHeight, dilationWidth] = parseTupleParam(dilations); \n\n const\n effectiveFilterHeight = \n getEffectiveFilterSize(filterHeight, dilationHeight); \n\n const\n effectiveFilterWidth =\n getEffectiveFilterSize(filterWidth, dilationWidth); \n\n const {padInfo, outHeight, outWidth} =\n getPadAndOutInfo(\n pad, inHeight, inWidth, strideHeight, strideWidth, effectiveFilterHeight, \n effectiveFilterWidth, roundingMode, dataFormat); \n\n const\n outChannels = depthwise ? filterChannels *\n inChannels : filterChannels; \n\n let outShape: [number, number, number, number]; \n\n if (dataFormat ===\n 'channelsFirst') {\n outShape = [batchSize, outChannels, outHeight, outWidth]; \n\n } else if (dataFormat ===\n 'channelsLast') {\n outShape = [batchSize, outHeight, outWidth, outChannels]; \n\n } \n\n return {\n batchSize, \n dataFormat, \n inHeight, \n inWidth, \n inChannels, \n outHeight, \n outWidth, \n outChannels, \n padInfo, \n strideHeight, \n strideWidth, \n filterHeight, \n filterWidth, \n effectiveFilterHeight, \n effectiveFilterWidth, \n dilationHeight, \n dilationWidth, \n inShape, \n outShape, \n filterShape \n }; \n} \n\n** \n\n * Information about the forward pass of a 3D convolution/pooling operation. \n * It includes input and output shape,\n strides, filter size and padding \n * information. \n */ \nexport type Conv3DInfo = {\n batchSize: number, \n inDepth:\n number, \n inHeight: number, \n inWidth: number, \n inChannels: number, \n outDepth: number, \n outHeight:\n number, \n outWidth: number, \n outChannels: number, \n dataFormat: 'channelsFirst'|'channelsLast', \n strideDepth:\n number, \n strideHeight: number, \n strideWidth: number, \n dilationDepth: number, \n dilationHeight: number, \n dilationWidth: number, \n filterDepth: number, \n filterHeight: number, \n filterWidth: number, \n effectiveFilterDepth: number, \n effectiveFilterHeight: number, \n effectiveFilterWidth: number, \n padInfo:\n PadInfo3D, \n inShape: [number, number, number, number, number], \n outShape: [number, number, number,\n number, number], \n filterShape: [number, number, number, number, number] \n}; \n\n** \n\n * Computes the\n information\n for a forward pass of a 3D convolution/pooling \n * operation. \n */ \nexport function computeConv3DInfo(\n inShape: [number, number, number, number, number], \n filterShape: [number, number, number, number,\n number], \n strides: number|[number, number, number], \n dilations: number|[number, number, number], \n pad:\n 'same'|'valid'|number, \n depthwise = false, \n dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast', \n
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roundingMode?: 'floor'|'round'|'ceil'): Conv3DInfo {\n let [batchSize, inDepth, inHeight, inWidth, inChannels] =\n
[-1, -1, -1, -1, -1];\n if (dataFormat === 'channelsLast') {\n [batchSize, inDepth, inHeight, inWidth, inChannels]
= inShape;\n } else if (dataFormat === 'channelsFirst') {\n [batchSize, inChannels, inDepth, inHeight, inWidth] =
inShape;\n } else {\n throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n\n const [filterDepth,
filterHeight, filterWidth, , filterChannels] =\n filterShape;\n const [strideDepth,
strideHeight, strideWidth] = parse3TupleParam(strides);\n const [dilationDepth, dilationHeight, dilationWidth] =\n
parse3TupleParam(dilations);\n\n const effectiveFilterDepth =\n getEffectiveFilterSize(filterDepth,
dilationDepth);\n const effectiveFilterHeight =\n getEffectiveFilterSize(filterHeight, dilationHeight);\n const
effectiveFilterWidth =\n getEffectiveFilterSize(filterWidth, dilationWidth);\n const {padInfo, outDepth,
outHeight, outWidth} = get3DPadAndOutInfo(\n pad, inDepth, inHeight, inWidth, strideDepth, strideHeight,
strideWidth,\n effectiveFilterDepth, effectiveFilterHeight, effectiveFilterWidth,\n roundingMode);\n\n const
outChannels = depthwise ? filterChannels * inChannels : filterChannels;\n\n let outShape: [number, number,
number, number, number];\n if (dataFormat === 'channelsFirst') {\n outShape = [batchSize, outChannels,
outDepth, outHeight, outWidth];\n } else if (dataFormat === 'channelsLast') {\n outShape = [batchSize,
outDepth, outHeight, outWidth, outChannels];\n }\n\n return {\n batchSize,\n dataFormat,\n inDepth,\n
inHeight,\n inWidth,\n inChannels,\n outDepth,\n outHeight,\n outWidth,\n outChannels,\n padInfo,\n
strideDepth,\n strideHeight,\n strideWidth,\n filterDepth,\n filterHeight,\n filterWidth,\n
effectiveFilterDepth,\n effectiveFilterHeight,\n effectiveFilterWidth,\n dilationDepth,\n dilationHeight,\n
dilationWidth,\n inShape,\n outShape,\n filterShape\n };\n}\n\nfunction computeOutputShape2D(\n
inShape: [number, number], fieldSize: number, stride: number,\n zeroPad?: number, roundingMode?:
'floor'|'round'|'ceil'): [number, number] {\n if (zeroPad == null) {\n zeroPad = computeDefaultPad(inShape,
fieldSize, stride);\n }\n\n const inputRows = inShape[0];\n const inputCols = inShape[1];\n\n const outputRows =\n
round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n
const outputCols =\n
round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n\n return
[outputRows, outputCols];\n}\n\nfunction computeOutputShape4D(\n inShape: [number, number, number,
number], fieldSize: number,\n outChannels: number, stride: number, zeroPad?: number,\n roundingMode?:
'floor'|'round'|'ceil'): [number, number, number, number] {\n if (zeroPad == null) {\n zeroPad =
computeDefaultPad(inShape, fieldSize, stride);\n }\n\n const inputDepth = inShape[0];\n const inputRows =
inShape[1];\n const inputCols = inShape[2];\n\n const outputDepths =\n
round((inputDepth - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n const outputRows =\n
round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n const outputCols =\n
round((inputCols - fieldSize + 2 * zeroPad) / stride + 1,
roundingMode);\n\n return [outputDepths, outputRows, outputCols, outChannels];\n}\n\nexport function
computeDefaultPad(\n inputShape:
[number, number][[number, number, number, number],\n fieldSize: number, stride: number, dilation = 1): number
{\n const effectiveFieldSize = getEffectiveFilterSize(fieldSize, dilation);\n return Math.floor(\n
(inputShape[0]
* (stride - 1) - stride + effectiveFieldSize) / 2);\n}\n\nfunction parseTupleParam(param: number|number[]):
[number, number, number] {\n if (typeof param === 'number') {\n return [param, param, param];\n }\n if
(param.length === 2) {\n return [param[0], param[1], 1];\n }\n return param as [number, number,
number];\n}\n\nfunction parse3TupleParam(param: number|[number, number, number]):\n [number, number,
number] {\n return typeof param === 'number' ? [param, param, param] : param;\n}\n\n/* See
https://www.tensorflow.org/api_docs/python/tf/nn/atrous_conv2d\n * Atrous convolution is equivalent to standard
convolution with upsampled\n * filters with effective_filter_height =\n * filter_height + (filter_height - 1) * (dilation
- 1)\n * and effective_filter_width =\n * filter_width + (filter_width - 1) * (dilation - 1),\n * produced by inserting dilation
- 1 zeros along consecutive elements across\n * the filters' spatial dimensions.\n * When there is a dilation, this
converts a filter dimension to the\n * effective filter dimension, so it can be used in a standard convolution.\n
*\n\nfunction getEffectiveFilterSize(filterSize: number, dilation: number) {\n if (dilation <= 1) {\n return
filterSize;\n }\n\n return filterSize + (filterSize - 1) * (dilation - 1);\n}\n\nfunction getPadAndOutInfo(\n pad:

```

```

'same'|'valid'|number|ExplicitPadding, inHeight: number,\n inWidth: number, strideHeight: number, strideWidth:
number,\n filterHeight: number, filterWidth: number,\n roundingMode: 'floor'|'round'|'ceil',\n dataFormat:
'channelsFirst'|\n 'channelsLast'): {padInfo: PadInfo, outHeight: number, outWidth: number} {\n let padInfo:
PadInfo;\n let outHeight: number;\n let outWidth: number;\n if (typeof
pad === 'number') {\n const padType = (pad === 0) ? 'VALID' : 'NUMBER';\n padInfo = {top: pad, bottom:
pad, left: pad, right: pad, type: padType};\n const outShape = computeOutputShape2D(\n [inHeight, inWidth],
filterHeight, strideHeight, pad, roundingMode);\n outHeight = outShape[0];\n outWidth = outShape[1];\n } else
if (pad === 'same') {\n outHeight = Math.ceil(inHeight / strideHeight);\n outWidth = Math.ceil(inWidth /
strideWidth);\n const padAlongHeight =\n Math.max(0, (outHeight - 1) * strideHeight + filterHeight -
inHeight);\n const padAlongWidth =\n Math.max(0, (outWidth - 1) * strideWidth + filterWidth - inWidth);\n const top = Math.floor(padAlongHeight / 2);\n const bottom = padAlongHeight - top;\n const left =
Math.floor(padAlongWidth / 2);\n const right = padAlongWidth - left;\n padInfo = {top, bottom, left, right, type:
'SAME'};\n } else if (pad === 'valid') {\n padInfo = {top: 0, bottom: 0, left: 0, right:
0, type: 'VALID'};\n outHeight = Math.ceil((inHeight - filterHeight + 1) / strideHeight);\n outWidth =
Math.ceil((inWidth - filterWidth + 1) / strideWidth);\n } else if (typeof pad === 'object') {\n const top =
dataFormat === 'channelsLast' ? pad[1][0] : pad[2][0];\n const bottom = dataFormat === 'channelsLast' ?
pad[1][1] : pad[2][1];\n const left = dataFormat === 'channelsLast' ? pad[2][0] : pad[3][0];\n const right =
dataFormat === 'channelsLast' ? pad[2][1] : pad[3][1];\n const padType = (top === 0 && bottom === 0 && left
=== 0 && right === 0) ?\n 'VALID' : 'EXPLICIT';\n padInfo = {top, bottom, left, right, type:
padType};\n outHeight = round(\n (inHeight - filterHeight + top + bottom) / strideHeight + 1,\n roundingMode);\n outWidth = round(\n (inWidth - filterWidth + left + right) / strideWidth + 1,\n roundingMode);\n } else {\n throw Error(`Unknown padding parameter: ${pad}`);\n }\n return {padInfo,
outHeight,
outWidth};\n}\n\nfunction get3DPadAndOutInfo(\n pad: 'same'|'valid'|number, inDepth: number, inHeight:
number,\n inWidth: number, strideDepth: number, strideHeight: number,\n strideWidth: number, filterDepth:
number, filterHeight: number,\n filterWidth: number, roundingMode?: 'floor'|'round'|'ceil'): {\n padInfo:
PadInfo3D,\n outDepth: number,\n outHeight: number,\n outWidth: number}\n {\n let padInfo: PadInfo3D;\n let
outDepth: number;\n let outHeight: number;\n let outWidth: number;\n if (typeof pad === 'number') {\n const
padType = (pad === 0) ? 'VALID' : 'NUMBER';\n padInfo = {\n top: pad,\n bottom: pad,\n left: pad,\n
 right: pad,\n front: pad,\n back: pad,\n type: padType\n };\n const outShape =
computeOutputShape4D(\n [inDepth, inHeight, inWidth, 1], filterDepth, 1, strideDepth, pad,\n roundingMode);\n outDepth = outShape[0];\n outHeight = outShape[1];\n outWidth = outShape[2];\n }
else if (pad === 'same') {\n outDepth = Math.ceil(inDepth / strideDepth);\n outHeight = Math.ceil(inHeight /
strideHeight);\n outWidth = Math.ceil(inWidth / strideWidth);\n const padAlongDepth = (outDepth - 1) *
strideDepth + filterDepth - inDepth;\n const padAlongHeight =\n (outHeight - 1) * strideHeight + filterHeight
- inHeight;\n const padAlongWidth = (outWidth - 1) * strideWidth + filterWidth - inWidth;\n const front =
Math.floor(padAlongDepth / 2);\n const back = padAlongDepth - front;\n const top =
Math.floor(padAlongHeight / 2);\n const bottom = padAlongHeight - top;\n const left =
Math.floor(padAlongWidth / 2);\n const right = padAlongWidth - left;\n padInfo = {top, bottom, left, right,
front, back, type: 'SAME'};\n } else if (pad === 'valid') {\n padInfo = {\n top: 0,\n bottom: 0,\n
 left: 0,\n right: 0,\n front: 0,\n back: 0,\n type: 'VALID'\n };\n outDepth =
Math.ceil((inDepth - filterDepth + 1) / strideDepth);\n outHeight = Math.ceil((inHeight - filterHeight + 1) /
strideHeight);\n outWidth = Math.ceil((inWidth - filterWidth + 1) / strideWidth);\n } else {\n throw
Error(`Unknown padding parameter: ${pad}`);\n }\n return {padInfo, outDepth, outHeight, outWidth};\n}\n\n**\n * Rounds a value depending on the
rounding mode\n * @param value\n * @param roundingMode A string from: 'ceil', 'round', 'floor'. If none is\n *
provided, it will default to truncate.\n *\n\nfunction round(value: number, roundingMode?: 'floor'|'round'|'ceil') {\n if
(!roundingMode) {\n return Math.trunc(value);\n }\n switch (roundingMode) {\n case 'round':\n // used for
Caffe Conv\n return Math.round(value);\n case 'ceil':\n // used for Caffe Pool\n return Math.ceil(value);\n }
}

```



```

 case 'floor':\n return Math.floor(value);\n default:\n throw new Error(`Unknown roundingMode
${roundingMode}`);\n }\n}\n\nexport function tupleValuesAreOne(param:
 number|number[]): boolean {\n const [dimA, dimB, dimC] = parseTupleParam(param);\n return dimA === 1 &&
dimB === 1 && dimC === 1;\n}\n}\n\nexport function eitherStridesOrDilationsAreOne(\n strides: number|number[],
dilations: number|number[]): boolean {\n return tupleValuesAreOne(strides) ||
tupleValuesAreOne(dilations);\n}\n\n/**\n * Convert Conv2D dataFormat from 'NHWC'|'NCHW' to\n *
'channelsLast'|'channelsFirst'\n * @param dataFormat in 'NHWC'|'NCHW' mode\n * @return dataFormat in
'channelsLast'|'channelsFirst' mode\n * @throws unknown dataFormat\n */\nexport function
convertConv2DDataFormat(dataFormat: 'NHWC'|'NCHW'):\n 'channelsLast'|'channelsFirst' {\n if (dataFormat
=== 'NHWC') {\n return 'channelsLast';\n } else if (dataFormat === 'NCHW') {\n return 'channelsFirst';\n
} else {\n throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n}\n\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,
Version 2.0 (the `License`);\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS`
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ENGINE} from './engine';\nimport {Reshape, ReshapeAttrs, ReshapeInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank,
ShapeMap, TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Reshapes a `tf.Tensor` to a given shape.\n * \n * Given an input tensor, returns a new tensor with the same values
as the\n * input tensor with shape `shape`.\n * \n * If one component of shape is the special value -1, the size of
that\n * dimension is computed so that the total size remains constant. In\n * particular, a shape of [-1] flattens into
1-D. At most one component of\n * shape can be -1.\n * \n * If shape is 1-D or higher, then the operation returns a
tensor with shape\n * shape filled with the values of tensor. In this case, the number of\n * elements implied by
shape must be the same as the number of elements in\n * tensor.\n * \n * ```\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * x.reshape([2, 2]).print();\n * ```\n * \n * @param x The input tensor to be reshaped.\n * @param shape An array of
integers defining the output tensor shape.\n * \n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n
*/\n\nfunction reshape_<R extends Rank>(\n x: Tensor|TensorLike,\n shape: ShapeMap[R]): Tensor<R> {\n const $x = convertToTensor(x, 'x', 'reshape', 'string_or_numeric');\n \n const
inputs: ReshapeInputs = {x: $x};\n const attrs: ReshapeAttrs = {shape};\n return ENGINE.runKernel(\n Reshape, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const reshape =
op({reshape_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {ENGINE} from './engine';\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {cast} from
'./cast';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes the 2D average pooling of an image.\n * \n * @param x The input tensor, of rank 4

```

```

or rank 3 of shape` [batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.`@param filterSize`
The filter size: `[filterHeight, filterWidth]`. If`filterSize` is a single number, then`filterHeight ==
filterWidth`.`@param strides` The strides of the pooling: `[strideHeight,
strideWidth]`. If`strides` is a single number, then`strideHeight == strideWidth`.`@param pad` The type
of padding algorithm:`- `same` and stride 1: output will be of same size as input,`regardless of filter
size.`- `valid`: output will be smaller than input if filter is larger`than 1x1.`- For more info, see
this guide: https://www.tensorflow.org/api_guides/python/nn#Convolution`
https://www.tensorflow.org/api_guides/python/nn#Convolution)`@param dimRoundingMode` A string from:
'ceil', 'round', 'floor'. If none is`provided`, it will default to truncate.`/function avgPool<T extends
Tensor3D|Tensor4D>(`x: T|TensorLike, filterSize: [number, number]|number,`strides: [number,
number]|number, pad: 'valid'|'same'|number,`dimRoundingMode?: 'floor'|'round'|'ceil'): T {`const $x =
convertToTensor(x, 'x', 'avgPool', 'float32');`const dilations = 1;`util.assert(`conv_util.eitherStridesOrDilationsAreOne(strides,
dilations),`() => 'Error in avgPool: Either strides or dilations must be 1. '`+`Got strides ${strides} and
dilations '${dilations}'`);`let x4D = $x as Tensor4D;`let reshapedTo4D = false;`if ($x.rank === 3) {`reshapedTo4D = true;`x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);`}`}`util.assert(`x4D.rank === 4,`() => `Error in avgPool: x must be rank 4 but got rank ${x4D.rank}`);`if
(dimRoundingMode != null) {`util.assert(`util.isInt(pad as number),`() => `Error in avgPool: pad
must be an integer when using, `+`dimRoundingMode ${dimRoundingMode} but got pad ${pad}`);`}`}`const inputs: AvgPoolInputs = {x: x4D};`const attrs: AvgPoolAttrs = {filterSize, strides, pad,
dimRoundingMode};`// tslint:disable-next-line: no-unnecessary-type-assertion`let res =
ENGINE.runKernel(`AvgPool, inputs as {} as NamedTensorMap,`
attrs as {} as NamedAttrMap) as T;`res = cast(res, $x.dtype);`if (reshapedTo4D) {`return
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;`}`return res;`}`}`export const avgPool =
op({avgPool_});`"/**`@license`Copyright 2020 Google LLC. All Rights Reserved.`Licensed under
the Apache License, Version 2.0 (the "License");`you may not use this file except in compliance with the
License.`You may obtain a copy of the License at`http://www.apache.org/licenses/LICENSE-2.0`Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed
on an "AS IS" BASIS,`WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.`See the License for the specific language governing permissions and
limitations under the
License.`
=====
*/`import {ENGINE}
from './engine';`import {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs} from './kernel_names';`import
{NamedAttrMap} from './kernel_registry';`import {Tensor4D, Tensor5D} from './tensor';`import
{NamedTensorMap} from './tensor_types';`import {convertToTensor} from './tensor_util_env';`import
{TensorLike} from './types';`import * as util from './util';`import {cast} from './cast';`import {op} from
 './operation';`import {reshape} from './reshape';`/**`Computes the 3D average pooling.``js`const
x = tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]);`const result = tf.avgPool3d(x, 2, 1, 'valid');`
result.print();``@param x`The input tensor, of rank 5 or rank 4 of shape`[batch, depth, height,
width, inChannels]`.`@param filterSize`The filter size:`[filterDepth, filterHeight, filterWidth]`. If
`filterSize` is a single number, then`filterDepth == filterHeight == filterWidth`.`@param
strides`The strides of the pooling:`[strideDepth, strideHeight, strideWidth]`. If`strides` is a single
number, then`strideDepth == strideHeight == strideWidth`.`@param pad`The type of padding
algorithm.`- `same` and stride 1: output will be of same size as input,`regardless of filter size.`-
`valid`: output will be smaller than input if filter is larger`than 1*1x1.`- For more info, see this guide:
https://www.tensorflow.org/api_guides/python/nn#Convolution`
https://www.tensorflow.org/api_guides/python/nn#Convolution)`@param dimRoundingMode` A string from:

```

```

'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
@param dataFormat An optional string from: "NDHWC", "NCDHW". Defaults to "NDHWC". Specify the data format of the input and output data. With the default format "NDHWC", the data is stored in the order of: [batch, depth, height, width, channels]. Only "NDHWC" is currently supported.
@doc {heading: 'Operations', subheading: 'Convolution'}
function avgPool3d<T extends Tensor4D|Tensor5D>(x: T|TensorLike, filterSize: [number, number, number]|number, strides: [number, number, number]|number, pad: 'valid'|'same'|number, dimRoundingMode?: 'floor'|'round'|'ceil', dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {
 const $x = convertToTensor(x, 'x', 'avgPool3d', 'float32');
 let x5D = $x as Tensor5D;
 let reshapedTo5D = false;
 if ($x.rank === 4) {
 reshapedTo5D = true;
 x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);
 }
 util.assert(x5D.rank === 5, () => `Error in avgPool3d: x must be rank 5 but got rank ${x5D.rank}.`);
 util.assert(dataFormat === 'NDHWC', () => `Error in avgPool3d: Only NDHWC is currently supported, ` + `but got dataFormat of ${dataFormat}`);
 if (dimRoundingMode != null) {
 util.assert(util.isInt(pad as number), () => `Error in avgPool3d: pad must be an integer when using, ` + `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
 }
 const inputs: AvgPool3DInputs = {x: x5D};
 const attrs: AvgPool3DAttrs = {filterSize, strides, pad, dimRoundingMode, dataFormat};
 // tslint:disable-next-line: no-unnecessary-type-assertion
 let res = ENGINE.runKernel(AvgPool3D, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as T;
 res = cast(res, x5D.dtype);
 if (reshapedTo5D) {
 return reshape(res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as T;
 }
 return res;
}
export const avgPool3d = op({avgPool3d});
/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
import {ENGINE} from '../engine';
import {Concat, ConcatAttrs, ConcatInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensorArray} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assert} from '../util';
import {clone} from './clone';
import {op} from './operation';
/**
 * Concatenates a list of `tf.Tensor`s along a given axis.
 * The tensors ranks and types must match, and their sizes must match in all dimensions except `axis`.
 * Also available are stricter rank-specific methods that assert that `tensors` are of the given rank:
 * - `tf.concat1d`
 * - `tf.concat2d`
 * - `tf.concat3d`
 * - `tf.concat4d`
 * Except `tf.concat1d` (which does not have axis param), all methods have same signature as this method.
 * ```js
 * const a = tf.tensor1d([1, 2]);
 * const b = tf.tensor1d([3, 4]);
 * a.concat(b).print(); // or a.concat(b)
 * ```
 * ```js
 * const a = tf.tensor1d([1, 2]);
 * const b = tf.tensor1d([3, 4]);
 * const c = tf.tensor1d([5, 6]);
 * tf.concat([a, b, c]).print();
 * ```
 * ```js
 * const a = tf.tensor2d([[1, 2], [10, 20]]);
 * const b = tf.tensor2d([[3, 4], [30, 40]]);
 * const axis = 1;
 * tf.concat([a, b], axis).print();
 * ```
 * @param tensors A list of tensors to concatenate.
 * @param axis The axis to concatenate along. Defaults to 0 (the first dim).
 * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
 */
function concat<T extends Tensor>(tensors: Array<T|TensorLike>, axis = 0): T {
 assert(tensors.length >= 1, () => 'Pass at least one tensor to concat');
 const $tensors = convertToTensorArray(tensors, 'tensors', 'concat', 'string_or_numeric');
 if ($tensors[0].dtype === 'complex64') {
 $tensors.forEach(tensor => {
 if (tensor.dtype !== 'complex64') {
 throw new Error(`Cannot concatenate complex64 tensors with a tensor with dtype ${tensor.dtype}.`);
 }
 });
 }
 if

```

```

($sensors.length === 1) {\n return clone($sensors[0]);\n }\n\n const inputs: ConcatInputs = $sensors;\n const attr:
ConcatAttrs = {axis};\n\n return ENGINE.runKernel(\n Concat, inputs as {} as NamedTensorMap, attr as {} as
NamedAttrMap);\n}\n\nexport const concat = op({concat_});\n", "/*\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Sigmoid, SigmoidInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/*\n *
Computes sigmoid element-wise, $1 / (1 + \exp(-x))$ \n * \n * ``js\n * const x = tf.tensor1d([0, -1, 2, -3]);\n *\n *
x.sigmoid().print(); // or tf.sigmoid(x)\n * ``\n * @param x The input tensor.\n * \n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n */\nfunction sigmoid_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'sigmoid');\n\n const inputs: SigmoidInputs = {x: $x};\n\n return
ENGINE.runKernel(Sigmoid, inputs as {} as NamedTensorMap);\n}\n\nexport const sigmoid =
op({sigmoid_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Slice, SliceAttrs, SliceInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, TensorLike} from
 './types';\n\nimport {op} from './operation';\n\n/*\n * Extracts a slice from a `tf.Tensor` starting at coordinates
`begin`\n * and is of size `size`.\n * \n * Also available are stricter rank-specific methods with the same signature\n *
as this method that assert that `x` is of the given rank:\n * - `tf.slice1d`\n * - `tf.slice2d`\n * - `tf.slice3d`\n * -
`tf.slice4d`\n * \n * ``js\n * const x = tf.tensor1d([1,
2, 3, 4]);\n *\n * x.slice([1], [2]).print();\n * ``\n * \n * ``js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n *
x.slice([1, 0], [1, 2]).print();\n * ``\n * @param x The input `tf.Tensor` to slice from.\n * @param begin The
coordinates to start the slice from. The length can be\n * less than the rank of x - the rest of the axes will have
implicit 0 as\n * start. Can also be a single number, in which case it specifies the\n * first axis.\n * @param size
The size of the slice. The length can be less than the rank of\n * x - the rest of the axes will have implicit -1. A
value of -1 requests\n * the rest of the dimensions in the axis. Can also be a single number,\n * in which case it
specifies the size of the first axis.\n * \n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\n
function slice_<R extends Rank, T extends Tensor<R>>(\n x: T|TensorLike, begin: number|number[], size?:
number|number[]): T {\n const $x = convertToTensor(x,
'x', 'slice', 'string_or_numeric');\n\n if ($x.rank === 0) {\n throw new Error('Slicing scalar is not possible');\n
 }\n\n const inputs: SliceInputs = {x: $x};\n const attrs: SliceAttrs = {begin, size};\n\n return
ENGINE.runKernel(\n Slice, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\n\nexport
const slice = op({slice_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====

```

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```
* =====\n*\n* \nimport {ENGINE} from './engine';\nimport {Tanh, TanhInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes\n hyperbolic tangent of the input `tf.Tensor` element-wise: `tanh(x)`\n *\n * `js`\n * const x = tf.tensor1d([0, 1, -1,\n 70]);\n *\n * x.tanh().print(); // or tf.tanh(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading:\n 'Operations', subheading: 'Basic math'}\n *\n * \nfunction tanh_<T extends Tensor>(x: T|TensorLike): T {\n const $x =\n convertToTensor(x, 'x', 'tanh');\n \n const inputs: TanhInputs = {x: $x};\n \n return ENGINE.runKernel(Tanh, inputs\n as {} as NamedTensorMap);\n}\n\nexport const tanh = op({tanh_});\n\n"/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n */
```

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```
* =====\n*\n* \nimport {Scalar, Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {add} from './add';\nimport {concat} from\n './concat';\nimport {matMul} from './mat_mul';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport\n {sigmoid} from './sigmoid';\nimport\n {slice} from './slice';\nimport {tanh} from './tanh';\n\n/**\n * Computes the next state and output of a\n BasicLSTMCell.\n *\n * Returns `[newC, newH]`.\n *\n * Derived from tf.contrib.rnn.BasicLSTMCell.\n *\n * @param forgetBias Forget bias for the cell.\n * @param lstmKernel The weights for the cell.\n * @param lstmBias The bias for the cell.\n * @param data The input to the cell.\n * @param c Previous cell state.\n * @param h Previous cell output.\n *\n * @doc {heading: 'Operations', subheading: 'RNN'}\n *\n * \nfunction basicLSTMCell_(\n forgetBias: Scalar|TensorLike, lstmKernel: Tensor2D|TensorLike,\n lstmBias: Tensor1D|TensorLike, data:\n Tensor2D|TensorLike,\n c: Tensor2D|TensorLike, h: Tensor2D|TensorLike): [Tensor2D, Tensor2D] {\n const\n $forgetBias =\n convertToTensor(forgetBias, 'forgetBias', 'basicLSTMCell');\n const $lstmKernel =\n convertToTensor(lstmKernel, 'lstmKernel', 'basicLSTMCell');\n const $lstmBias = convertToTensor(lstmBias,\n 'lstmBias',\n 'basicLSTMCell');\n const $data = convertToTensor(data, 'data', 'basicLSTMCell');\n const $c =\n convertToTensor(c, 'c', 'basicLSTMCell');\n const $h = convertToTensor(h, 'h', 'basicLSTMCell');\n \n const\n combined =\n concat([$data, $h], 1);\n const\n weighted =\n matMul(combined, $lstmKernel);\n const\n res: Tensor2D =\n add(weighted, $lstmBias);\n \n // i = input_gate, j = new_input, f = forget_gate, o = output_gate\n const\n batchSize =\n res.shape[0];\n const\n sliceCols =\n res.shape[1] / 4;\n const\n sliceSize: [number, number] =\n [batchSize, sliceCols];\n \n const\n i =\n slice(res, [0, 0], sliceSize);\n const\n j =\n slice(res, [0, sliceCols], sliceSize);\n const\n f =\n slice(res, [0,\n sliceCols * 2], sliceSize);\n const\n o =\n slice(res, [0, sliceCols * 3], sliceSize);\n \n const\n newC: Tensor2D =\n add(mul(sigmoid(i), tanh(j)),\n mul($c, sigmoid(add($forgetBias, f) as Tensor2D)));\n const\n newH: Tensor2D =\n mul(tanh(newC), sigmoid(o));\n \n return [newC, newH];\n}\n\nexport const basicLSTMCell\n = op({basicLSTMCell_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n */\nLicensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0
```

software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {BatchToSpaceND, BatchToSpaceNDAttrs,\nBatchToSpaceNDInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * This operation reshapes the \"batch\" dimension 0 into `M + 1`\n * dimensions of\n * shape `blockShape + [batch]`, interleaves these blocks back into the grid\n * defined by the spatial dimensions `[1, ..., M]`, to obtain a result with\n * the same rank as the input. The spatial dimensions of this\n * intermediate\n * result are then optionally cropped according to `crops` to produce the\n * output. This is the reverse of `tf.spaceToBatchND`. See below for a precise\n * description.\n *\n * ```js\n * const x = tf.tensor4d([1, 2, 3, 4], [4, 1, 1, 1]);\n * const blockShape = [2, 2];\n * const crops = [[0, 0], [0, 0]];\n *\n * x.batchToSpaceND(blockShape, crops).print();\n *\n * @param x A `tf.Tensor`. N-D with `x.shape` = `[batch] + spatialShape +\n * remainingShape`, where spatialShape has `M` dimensions.\n *\n * @param blockShape A 1-D array. Must have shape `[M]`, all values must\n * be ≥ 1 . \n * @param crops A 2-D array. Must have shape `[M, 2]`, all values must be ≥ 0 . \n * `crops[i] = [cropStart, cropEnd]` specifies the amount to crop from input\n * dimension `i + 1`, which corresponds to spatial dimension `i`. It is required\n * that `cropStart[i] + cropEnd[i] <= blockShape[i] * inputShape[i + 1]`\n *\n * This operation is equivalent to the following steps:\n *\n * 1. Reshape `x` to `reshaped` of shape: `[blockShape[0], ..., blockShape[M-1], batch /\n * prod(blockShape), x.shape[1], ..., x.shape[N-1]]`\n *\n * 2. Permute dimensions of `reshaped` to produce `permuted` of shape `[batch /\n * prod(blockShape), x.shape[1], blockShape[0], ..., x.shape[M],\n * blockShape[M-1], x.shape[M+1], ..., x.shape[N-1]]`\n *\n * 3. Reshape `permuted` to produce `reshapedPermuted` of shape `[batch /\n * prod(blockShape), x.shape[1] * blockShape[0], ..., x.shape[M] * blockShape[M-1],\n * x.shape[M+1], ..., x.shape[N-1]]`\n *\n * 4. Crop the start and end of dimensions `[1, ..., M]` of `reshapedPermuted`\n * according to `crops` to produce the output of shape: `[batch /\n * prod(blockShape), x.shape[1] * blockShape[0] - crops[0,0] - crops[0,1],\n * ..., x.shape[M] * blockShape[M-1] - crops[M-1,0] - crops[M-1,1], x.shape[M+1],\n * ..., x.shape[N-1]]`\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction batchToSpaceND<T extends Tensor>(\n x: T|TensorLike, blockShape: number[], crops: number[][]): T {\n const $x = convertToTensor(x, 'x', 'batchToSpaceND');\n const prod = blockShape.reduce((a, b) => a * b);\n util.assert($x.rank >= 1 + blockShape.length,\n () => `input rank is ${$x.rank} but should be > than blockShape.length ${\n blockShape.length}`);\n util.assert(crops.length === blockShape.length,\n () => `crops.length is ${\n crops.length} but should be equal to blockShape.length ${\n blockShape.length}`);\n util.assert($x.shape[0] % prod === 0,\n () => `input tensor batch is ${\n $x.shape[0]} but is not divisible by the product of ` +\n `the elements of blockShape ${blockShape.join(' *')} === ${prod}`);\n const inputs: BatchToSpaceNDInputs = {x: $x};\n const attrs: BatchToSpaceNDAttrs = {blockShape, crops};\n return ENGINE.runKernel(BatchToSpaceND, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n}\n\nexport const batchToSpaceND = op({batchToSpaceND_});\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\nimport {Tensor, Tensor4D} from './tensor';\nimport {Rank} from './types';\nimport {reshape} from './reshape';\n\nexport function xAs4D<R extends Rank>(x: Tensor<R>) {\n let x4D: Tensor4D;\n if (x.rank === 0
```

```

|| x.rank === 1) {\n x4D = reshape(x, [1, 1, 1, x.size]);\n } else if (x.rank === 2) {\n x4D = reshape(x, [1, 1,
x.shape[0], x.shape[1]]);\n } else if (x.rank === 3) {\n x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n
} else {\n x4D = x as Tensor4D;\n }\n\n return x4D;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n
 * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n
=====
*\n\nimport {ENGINE} from './engine';\nimport {FusedBatchNorm, FusedBatchNormAttrs,
FusedBatchNormInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor, Tensor1D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {Rank, TensorLike} from './types';\nimport * as util from
 './util';\nimport {xAs4D} from './batchnorm_util';\nimport {op} from './operation';\nimport
{reshape} from './reshape';\n\n/**\n * Batch normalization.\n * As described in\n *
http://arxiv.org/abs/1502.03167.\n *\n * Mean, variance, scale, and offset can be
of two shapes:\n * - The same shape as the input.\n * - In the common case, the depth dimension is the last
dimension of x, so\n * the values would be an `tf.Tensor1D` of shape [depth].\n *\n * Also available are stricter
rank-specific methods with the same signature\n * as this method that assert that parameters passed are of given
rank\n * - `tf.batchNorm2d`\n * - `tf.batchNorm3d`\n * - `tf.batchNorm4d`\n *\n * @param x The input
Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n * @param offset An offset
Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float number to avoid dividing by
0.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n */\nfunction batchNorm_<R extends
Rank>(\n
 x: Tensor<R>|TensorLike, mean: Tensor<R>|Tensor1D|TensorLike,\n variance:
Tensor<R>|Tensor1D|TensorLike,\n offset?: Tensor<R>|Tensor1D|TensorLike,\n scale?:
Tensor<R>|Tensor1D|TensorLike,\n varianceEpsilon?: number): Tensor<R> {\n if (varianceEpsilon == null) {\n
varianceEpsilon = 0.001;\n }\n const $x = convertToTensor(x, 'x', 'batchNorm');\n const $mean =
convertToTensor(mean, 'mean', 'batchNorm');\n const $variance = convertToTensor(variance, 'variance',
'batchNorm');\n let $scale: Tensor<R>|Tensor1D;\n if (scale != null) {\n $scale = convertToTensor(scale, 'scale',
'batchNorm');\n }\n let $offset: Tensor<R>|Tensor1D;\n if (offset != null) {\n $offset = convertToTensor(offset,
'offset', 'batchNorm');\n }\n\n util.assert(\n $mean.rank === $variance.rank,\n () => 'Batch normalization
gradient requires mean and variance to have '\n +\n 'equal ranks.);\n util.assert(\n $offset == null ||
$mean.rank === $offset.rank,\n () =>
'Batch normalization gradient requires mean and offset to have '\n +\n 'equal ranks.);\n util.assert(\n $scale
== null || $mean.rank === $scale.rank,\n () => 'Batch normalization gradient requires mean and scale to have '\n
+\n 'equal ranks.);\n const x4D: Tensor4D = xAs4D($x);\n const inputs: FusedBatchNormInputs = {\n
x: x4D,\n scale: $scale,\n offset: $offset,\n mean: $mean,\n variance: $variance\n };\n\n const attrs:
FusedBatchNormAttrs = {varianceEpsilon};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const
res = ENGINE.runKernel(\n FusedBatchNorm, inputs as { } as NamedTensorMap,\n attrs as { }
as NamedAttrMap) as Tensor<R>;\n\n return reshape(res, $x.shape);\n}\n\nexport const batchNorm =
op({batchNorm_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\n\nimport {batchNorm} from './batchnorm';\nimport\n{op} from './operation';\n\n/**\n * Batch normalization, strictly for 2D. For the more relaxed version, see\n *\n`tf.batchNorm`\n *\n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A\nvariance\nTensor.\n * @param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A\nsmall float\nnumber to avoid dividing by 0.\n *\nfunction batchNorm2d_(\n x: Tensor2D|TensorLike, mean:\nTensor2D|Tensor1D|TensorLike,\n variance: Tensor2D|Tensor1D|TensorLike,\n offset?:\nTensor2D|Tensor1D|TensorLike,\n scale?: Tensor2D|Tensor1D|TensorLike,\n varianceEpsilon?: number):\nTensor2D\n {\n const $x = convertToTensor(x, 'x', 'batchNorm');\n const $mean = convertToTensor(mean, 'mean',\n'batchNorm');\n const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n let $scale:\nTensor2D|Tensor1D;\n if (scale != null) {\n $scale = convertToTensor(scale, 'scale', 'batchNorm');\n }\n let\n$offset: Tensor2D|Tensor1D;\n if (offset != null) {\n $offset = convertToTensor(offset, 'offset', 'batchNorm');\n }\n util.assert(\n $x.rank === 2,\n () => `Error in batchNorm2D: x must be rank 2 but got rank ` +\n ` ${$x.rank}.`);\n util.assert(\n $mean.rank === 2 || $mean.rank === 1,\n () => `Error in batchNorm2D: mean must be rank 2 or rank 1 but ` +\n `got rank ${$mean.rank}.`);\n util.assert(\n $variance.rank === 2 || $variance.rank === 1,\n () =>\n`Error in batchNorm2D: variance must be rank 2 or rank 1 ` +\n `but got rank ${$variance.rank}.`);\n if\n($scale != null) {\n util.assert(\n $scale.rank === 2 || $scale.rank === 1,\n () => `Error in batchNorm2D:\nscale must be rank 2 or rank 1 ` +\n `but got rank ${$scale.rank}.`);\n }\n if ($offset != null) {\n util.assert(\n $offset.rank === 2 || $offset.rank === 1,\n () => `Error in batchNorm2D: offset must be rank 2\nor rank 1 ` +\n `but got rank ${$offset.rank}.`);\n }\n return batchNorm($x, $mean, $variance, $offset,\n$scale, varianceEpsilon);\n}\n\nexport const batchNorm2d = op({batchNorm2d_});\n\n"/**\n *\n * @license\n *\nCopyright 2020 Google LLC. All Rights Reserved.\n *\nLicensed\nunder the Apache License, Version 2.0 (the "License");\n *\nyou may not use this file except in compliance with\nthe License.\n *\nYou may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n\n *\n * Unless required by applicable law or agreed to in writing, software\n *\ndistributed under the License is\n *distributed on an "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n *express or implied.\n *\n * See the License for the specific language governing permissions and\n *\n * limitations under\nthe License.\n *\n\n
```

```
=====\n\n*\nimport {Tensor1D, Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\n\nimport {batchNorm} from './batchnorm';\nimport\n{op} from './operation';\n\n/**\n *\n * Batch normalization, strictly for 3D. For the more relaxed version, see\n *\n`tf.batchNorm`\n *\n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n *\n * @param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float\nnumber to avoid dividing by 0.\n *\nfunction batchNorm3d_(\n x: Tensor3D|TensorLike, mean:\nTensor3D|Tensor1D|TensorLike,\n variance: Tensor3D|Tensor1D|TensorLike,\n offset?:\nTensor3D|Tensor1D|TensorLike,\n scale?: Tensor3D|Tensor1D|TensorLike,\n varianceEpsilon?: number):\nTensor3D\n {\n const $x = convertToTensor(x, 'x', 'batchNorm');\n const $mean = convertToTensor(mean, 'mean',\n'batchNorm');\n const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n let $scale:\nTensor3D|Tensor1D;\n if (scale != null) {\n $scale = convertToTensor(scale, 'scale', 'batchNorm');\n }\n let\n$offset: Tensor3D|Tensor1D;\n if (offset != null) {\n $offset = convertToTensor(offset, 'offset', 'batchNorm');\n }\n util.assert(\n $x.rank === 3,\n () => `Error
```



```

in batchNorm3D: x must be rank 3 but got rank ` +\n `${$x.rank}.`);\n util.assert(\n $mean.rank === 3 ||
$mean.rank === 1,\n () => `Error in batchNorm3D: mean must be rank 3 or rank 1 but ` +\n `got rank
${$mean.rank}.`);\n util.assert(\n $variance.rank === 3 || $variance.rank === 1,\n () => `Error in
batchNorm3D: variance must be rank 3 or rank 1 ` +\n `but got rank ${$variance.rank}.`);\n if ($scale !== null)
{\n util.assert(\n $scale.rank === 3 || $scale.rank === 1,\n () => `Error in batchNorm3D: scale must be
rank 3 or rank 1 ` +\n `but got rank ${$scale.rank}.`);\n } \n if ($offset !== null) {\n util.assert(\n
$offset.rank === 3 || $offset.rank === 1,\n () => `Error in batchNorm3D: offset must be rank 3 or rank 1 ` +\n
 `but got rank ${$offset.rank}.`);\n } \n\n return batchNorm($x, $mean, $variance, $offset, $scale,
varianceEpsilon);\n}\n\nexport const batchNorm3d = op({ batchNorm3d_ });\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\nimport {Tensor1D, Tensor4D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport * as util from '../util';\nimport {batchNorm} from './batchnorm';\nimport
{op} from './operation';\n\n/**\n * Batch
normalization, strictly for 4D. For the more relaxed version, see\n * `tf.batchNorm`. \n\n * @param x The input
Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n * @param offset An offset
Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float number to avoid dividing by
0.\n\n */\nfunction batchNorm4d_(\n x: Tensor4D|TensorLike, mean: Tensor4D|Tensor1D|TensorLike,\n variance:\n Tensor4D|Tensor1D|TensorLike,\n offset?: Tensor4D|Tensor1D|TensorLike, scale?:\n Tensor4D|Tensor1D|TensorLike,\n varianceEpsilon?: number): Tensor4D {\n const $x = convertToTensor(x, 'x',
'batchNorm');\n const $mean = convertToTensor(mean, 'mean', 'batchNorm');\n const $variance =
convertToTensor(variance, 'variance', 'batchNorm');\n let $scale: Tensor4D|Tensor1D;\n if (scale !== null) {\n
 $scale = convertToTensor(scale, 'scale', 'batchNorm');\n }\n let $offset: Tensor4D|Tensor1D;\n if (offset !== null)
{\n $offset = convertToTensor(offset,\n 'offset', 'batchNorm');\n }\n util.assert(\n $x.rank === 4,\n () => `Error in batchNorm4D: x must be rank 4
but got rank ` +\n `${$x.rank}.`);\n util.assert(\n $mean.rank === 4 || $mean.rank === 1,\n () => `Error
in batchNorm4D: mean must be rank 4 or rank 1 but ` +\n `got rank ${$mean.rank}.`);\n util.assert(\n
 $variance.rank === 4 || $variance.rank === 1,\n () => `Error in batchNorm4D: variance must be rank 4 or rank 1
` +\n `but got rank ${$variance.rank}.`);\n if ($scale !== null) {\n util.assert(\n $scale.rank === 4 ||
$scale.rank === 1,\n () => `Error in batchNorm4D: scale must be rank 4 or rank 1 ` +\n `but got rank
${$scale.rank}.`);\n }\n if ($offset !== null) {\n util.assert(\n $offset.rank === 4 || $offset.rank === 1,\n
 () => `Error in batchNorm4D: offset must be rank 4 or rank 1 ` +\n `but got rank ${$offset.rank}.`);\n }\n }\n\n return batchNorm($x, $mean,\n $variance, $offset, $scale, varianceEpsilon);\n}\n\nexport const batchNorm4d = op({ batchNorm4d_ });\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\nimport {ENGINE} from '../engine';\nimport {Bincount, BincountAttrs, BincountInputs} from
'../kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D}

```

```

from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from
 './operation';\n\n/**\n * Outputs a vector with length `size` and the same dtype as `weights`. \n * If `weights` are
 empty, then index `i` stores the number of times the value \n * `i` is counted in `x`. If `weights` are non-empty, then
 index `i` stores the \n * sum of the value in `weights` at each index where the corresponding value in \n * `x` is `i`. \n
 * Values in `x` outside of the range [0, size) are ignored. \n * \n * @param x The input int tensor, rank 1. \n *
 @param weights The weights tensor, must have the same shape as x, or a \n * length-0 Tensor, in which case it
 acts as all weights equal to 1. \n * @param size Non-negative integer. \n * \n * @doc {heading: 'Operations',
 subheading: 'Reduction'}\n */\nfunction bincount_<T extends Tensor1D>(\n x: T|TensorLike,\n weights: T|TensorLike, size: number): T {\n const $x = convertToTensor(x, 'x', 'bincount');\n const $weights =
 convertToTensor(weights, 'weights', 'bincount');\n util.assert(\n $x.dtype === 'int32',\n () => `Error in
 bincount: input ` +\n `dtype must be int32, but got ${$x.dtype}`);\n util.assert(size >= 0, () => `size must be
 non-negative, but got ${size}.`);\n util.assert(\n $weights.size === $x.size || $weights.size === 0,\n () =>
 `Error in bincount: weights must have the same size as input or ` +\n `0-length, but got input shape:
 ${$x.shape}, weights shape: ` +\n `${$weights.shape}.`);\n const inputs: BincountInputs = {x: $x, weights:
 $weights};\n const attrs: BincountAttrs = {size};\n return ENGINE.runKernel(\n Bincount, inputs as {} as
 NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const bincount = op({bincount_});\n\n"/**\n *
 @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
 under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
 the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
 Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
 distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
 the License.\n *
=====\n
*/\nimport {ENGINE} from './engine';\nimport {Tile, TileAttrs, TileInputs} from './kernel_names';\nimport
 {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, ShapeMap, TensorLike}
 from './types';\nimport {clone} from
 './clone';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Broadcast an array to a
 compatible shape NumPy-style. \n * The tensor's shape is compared to the broadcast shape from end to
 beginning. \n * Ones are prepended to the tensor's shape until it has the same length as \n * the broadcast
 shape. If input.shape[i]==shape[i], the (i+1)-th axis is \n * already broadcast-compatible. If input.shape[i]==1 and
 shape[i]==N, then \n * the input tensor is tiled N times along that axis (using tf.tile). \n * \n * @param input The
 tensor that is to be broadcasted. \n * @param shape The input is to be broadcast to this shape. \n * \n * @doc
 {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction broadcastTo_<R extends Rank>(\n x:
 Tensor|TensorLike, shape: ShapeMap[R]): Tensor<R> {\n let input = convertToTensor(x, 'broadcastTo', 'x');\n const
 xShape = input.shape;\n if (shape.some(d => !(d > 0) || d % 1 !== 0)) {\n throw new Error(`broadcastTo():
 Invalid
 broadcast shape [${shape}].`);\n }\n if (shape.length < input.rank) {\n throw new Error(`broadcastTo():
 shape.length=${shape.length} < input.rank=${\n input.rank}.`);\n }\n if (shape.length > input.rank) {\n
 const newShape = input.shape.slice();\n while (newShape.length < shape.length) {\n newShape.unshift(1);\n
 }\n input = reshape(input, newShape);\n }\n const inputShape = input.shape;\n const reps: number[] =
 Array.from(shape);\n for (let i = shape.length - 1; i >= 0; i--) {\n if (inputShape[i] === shape[i]) {\n
reps[i] = 1;\n } else if (inputShape[i] !== 1) {\n throw new Error(\n `broadcastTo(): [${xShape}] cannot be
 broadcast to [${shape}].`);\n }\n }\n const axes = reps.map((n, i) => n > 1 ? i : -1).filter(i => i >= 0);\n if
 (axes.length === 0) {\n return clone(input) as Tensor<R>;\n }\n // TODO call broadcastTo kernel directly once
 backends implement broadcastTo\n const inputs: TileInputs = {x:

```

```
input});\n const attrs: TileAttrs = {reps};\n return ENGINE.runKernel(\n Tile, inputs as { } as
NamedTensorMap, attrs as unknown as NamedAttrMap);\n}\n\nexport const broadcastTo =
op({broadcastTo_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Ceil, CeilInputs} from
'./kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from
'./operation';\n\n/*\n * Computes ceiling of input `tf.Tensor` element-wise: `ceil(x)`\n *\n * ```\n * const x =
tf.tensor1d([.6, 1.1, -3.3]);\n *\n * x.ceil().print(); // or tf.ceil(x)\n *\n * @param x The input Tensor.\n *\n *
@doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction ceil_<T extends Tensor>(x: T|TensorLike):
T {\n const $x = convertToTensor(x, 'x', 'ceil');\n const inputs: CeilInputs = {x: $x};\n return
ENGINE.runKernel(Ceil, inputs as { } as NamedTensorMap);\n}\n\nexport const ceil = op({ceil_});\n", "/*\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of
the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport * as util from './util';\n\nimport {op} from './operation';\n\n/*\n * Clips
values element-wise. `max(min(x, clipValueMax), clipValueMin)`\n *\n * ```\n * const
x = tf.tensor1d([-1, 2, -3, 4]);\n *\n * x.clipByValue(-2, 3).print(); // or tf.clipByValue(x, -2, 3)\n *\n * @param
x The input tensor.\n * @param clipValueMin Lower-bound of range to be clipped to.\n * @param clipValueMax
Upper-bound of range to be clipped to.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction clipByValue_<T extends Tensor>(x: T|TensorLike, clipValueMin: number, clipValueMax:
number): T {\n const $x = convertToTensor(x, 'x', 'clipByValue');\n util.assert(\n (clipValueMin <=
clipValueMax),\n () => `Error in clip: min (${clipValueMin}) must be ` +\n `less than or equal to max
(${clipValueMax}).`);\n const inputs: ClipByValueInputs = {x: $x};\n const attrs: ClipByValueAttrs =
{clipValueMin, clipValueMax};\n return ENGINE.runKernel(\n ClipByValue, inputs as { } as
NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const clipByValue = op({clipByValue_});\n", "/*\n *
@license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

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*\nimport {Tensor1D} from './tensor';\nimport {TensorLike} from './types';\n\nimport {concat} from
'./concat';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of tf.Tensor1D`s along an axis. See
`concat` for details.\n *\n * For example, if:\n * A: shape(3) = |r1, g1, b1|\n * B: shape(2) = |r2,
g2|\n * C = tf.concat1d([A, B]) == |r1, g1, b1, r2, g2|\n *\n * @param tensors A list of tf.Tensor`s to concatenate.\n
*\n * @return The concatenated array.\n *\nfunction concat1d_(tensors: Array<Tensor1D|TensorLike>): Tensor1D {\n
return concat(tensors, 0 /* axis */);\n}\n\nexport const concat1d = op({concat1d_});\n", "/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {Tensor2D} from './tensor';\nimport {TensorLike} from './types';\n\nimport {concat} from
'./concat';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of tf.Tensor2D`s along an axis. See
`concat` for details.\n *\n * For example, if:\n * A: shape(2, 3) = | r1, g1, b1 | \n * | r2, g2, b2 |\n *\n * B:
shape(2, 3) = | r3, g3, b3 | \n * | r4, g4, b4 |\n *\n * C = tf.concat2d([A, B], axis)\n *\n * if axis = 0:\n * C:
shape(4, 3) = | r1, g1, b1 | \n * | r2, g2, b2 | \n * | r3, g3, b3 | \n * | r4, g4, b4 |\n *\n * if
axis = 1:\n * C = shape(2, 6) = | r1, g1, b1, r3, g3, b3 | \n * | r2, g2, b2, r4, g4, b4 |\n *\n *\n * @param
tensors A list of `tf.Tensor`s to concatenate.\n *\n * @param axis The axis to concatenate along.\n *\n * @return The
concatenated array.\n *\nfunction concat2d_(\n tensors: Array<Tensor2D|TensorLike>, axis: number):
Tensor2D {\n return concat(tensors, axis);\n}\n\nexport const concat2d = op({concat2d_});\n", "/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {Tensor3D} from './tensor';\nimport {TensorLike} from './types';\n\nimport {concat} from
'./concat';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of `tf.Tensor3D`s
along an axis.\n * See `concat` for details.\n *\n * For example, if:\n * A: shape(2, 1, 3) = | r1, g1, b1 | \n *
 | r2, g2, b2 | \n *\n * B: shape(2, 1, 3) = | r3, g3, b3 | \n * | r4, g4, b4 | \n *\n * C = tf.concat3d([A, B],
axis)\n *\n * if axis = 0:\n * C: shape(4, 1, 3) = | r1, g1, b1 | \n * | r2, g2, b2 | \n * | r3, g3, b3
| \n * | r4, g4, b4 | \n *\n * if axis = 1:\n * C: shape(2, 2, 3) = | r1, g1, b1, r3, g3, b3 | \n *
 | r2, g2, b2, r4, g4, b4 | \n *\n * if axis = 2:\n * C = shape(2, 1, 6) = | r1, g1, b1, r3, g3, b3 | \n *
 | r2, g2, b2, r4, g4, b4 | \n *\n *\n * @param tensors A list of tf.Tensor`s to concatenate.\n *\n * @param axis The axis to concate
along.\n *\n * @return The concatenated array.\n *\nfunction concat3d_(\n tensors: Array<Tensor3D|TensorLike>,
axis: number): Tensor3D {\n return concat(tensors, axis);\n}\n\nexport const concat3d =
op({concat3d_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\nimport {Tensor4D} from './tensor';\nimport {TensorLike} from './types';\n\nimport {concat} from

```

./concat';\nimport {op} from './operation';\n\n/\*\*\n \* Concatenates a list of `tf.Tensor4D`s along an axis.\n \* See `concat` for details.\n \*/\n \* @param tensors

A list of `tf.Tensor`s to concatenate.\n \* @param axis The axis to concatenate along.\n \* @return The concatenated array.\n \*/\nfunction concat4d\_(\n tensors: Array<Tensor4D|TensorLike>, axis: number): Tensor4D {\n return concat(tensors, axis);\n}\n\nexport const concat4d = op({concat4d\_});\n\n"/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing,\n \* software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====\n\n*/\nimport {ENGINE} from '../engine';\nimport {Conv2D, Conv2DAttrs, Conv2DInputs} from\n '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D, Tensor4D} from\n '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from './util';\nimport * as conv_util\n from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 2D convolution over the input x.\n * @param x The input tensor, of rank 4 or rank 3, of shape\n * `[batch, height, width, inChannels]`. If rank 3, batch of 1 is\n * assumed.\n * @param filter The filter, rank 4, of shape\n * `[filterHeight, filterWidth, inDepth, outDepth]`.\n * @param strides The strides of the convolution: `[strideHeight,\n * strideWidth]`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of\n * same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is\n * larger\n * than 1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat: An optional string from:\n * `\"NHWC\"`, `\"NCHW\"`. Defaults to\n * `\"NHWC\"`. Specify the data format of the input and output data. With\n * the\n * default format `\"NHWC\"`, the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across\n * the height and width dimensions\n * in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single\n * number, then `dilationHeight == dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n * @param dimRoundingMode A string\n * from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\n * @doc {heading:\n * 'Operations', subheading: 'Convolution'}\n */\nfunction conv2d_<T extends Tensor3D|Tensor4D>(\n x:\n T|TensorLike, filter: Tensor4D|TensorLike,\n strides: [number, number]|number,\n pad:\n 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dilations:\n [number, number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x =\n convertToTensor(x, 'x', 'conv2d');\n const $filter = convertToTensor(filter, 'filter', 'conv2d');\n let x4D = $x as\n Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x,\n [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in conv2d:\n input must be rank 4, but got rank ${x4D.rank}.`);\n util.assert(\n $filter.rank === 4,\n () => `Error in\n conv2d: filter\n must be rank 4, but got rank ` +\n ` ${$filter.rank}.`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv2d: pad must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n }\n const inDepth = dataFormat ===\n 'NHWC' ? x4D.shape[3] : x4D.shape[1];\n util.assert(\n inDepth === $filter.shape[2],\n () => `Error in\n conv2d: depth of input (${inDepth}) must match ` +\n `input depth for filter ${$filter.shape[2]}.`);\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in conv2D: Either\n strides or dilations must be 1.` +\n `Got strides ${strides} and dilations '${dilations}'`);\n\n const inputs:
```

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Conv2DInputs = {x: x4D, filter: $filter};\n const attrs:\n Conv2DAttrs = {strides, pad, dataFormat, dilations,
dimRoundingMode};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n
const res = ENGINE.runKernel(\n Conv2D, inputs as {} as NamedTensorMap,\n attrs as {}
as NamedAttrMap as T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]])
as T;\n } \n return res;\n}\n\nexport const conv2d = op({conv2d_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {Tensor2D, Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {conv2d} from
'./conv2d';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes a 1D convolution over the input x.\n * \n * @param x The input tensor, of rank 3 or
rank 2, of shape\n * `[batch, width, inChannels]`. If rank 2, batch of 1 is assumed.\n * @param filter The filter,
rank 3, of shape\n * `[filterWidth, inDepth, outDepth]`.\n * @param stride The number of entries by which the
filter is moved right at\n * each step.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1:
output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input
if filter is larger\n * than 1x1.\n

```

```

* - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat An optional string from
`"NWC"`, `"NCW"`. Defaults to `"NWC"`,\n * the data is stored in the order of [batch, in_width, in_channels].
Only\n * `"NWC"` is currently supported.\n * @param dilation The dilation rate in which we sample input values
in\n * atrous convolution. Defaults to `1`. If it is greater than 1, then\n * stride must be `1`.\n * @param
dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n *\n *
@doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction conv1d_<T extends
Tensor2D|Tensor3D>(\n x: T|TensorLike, filter: Tensor3D|TensorLike, stride: number,\n pad:
'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NWC'|'NCW' = 'NWC', dilation = 1,\n dimRoundingMode?:

```

```

'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x', 'conv1d');\n const $filter = convertToTensor(filter,
'filter', 'conv1d');\n\n let x3D = $x as Tensor3D;\n let reshapedTo3D = false;\n if ($x.rank === 2) {\n
 reshapedTo3D = true;\n x3D = reshape($x, [1, $x.shape[0], $x.shape[1]]);\n }\n\n util.assert(\n x3D.rank ===
3,\n () => `Error in conv1d: input must be rank 3, but got rank ${x3D.rank}.`);\n util.assert(\n $filter.rank
=== 3,\n () => `Error in conv1d: filter must be rank 3, but got rank ` +\n `${$filter.rank}.`);\n if
(dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv1d: pad
must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n }\n\n
 util.assert(\n x3D.shape[2] === $filter.shape[1],\n () => `Error in conv1d: depth of input
(${x3D.shape[2]}) must match ` +\n `input depth for filter
${$filter.shape[1]}.`);\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(stride, dilation),\n () =>
`Error in conv1D: Either stride or dilation must be 1.` +\n `Got stride ${stride} and dilation '${dilation}'`);\n
 util.assert(\n dataFormat === 'NWC',\n () => `Error in conv1d: got dataFormat of ${\n dataFormat} but
only NWC is currently supported.`);\n\n const filter4D = reshape(\n $filter, [1, $filter.shape[0], $filter.shape[1],
$filter.shape[2]]);\n const input4D = reshape(x3D, [x3D.shape[0], 1, x3D.shape[1], x3D.shape[2]]);\n const strides:
[number, number] = [1, stride];\n const dilations: [number, number] = [1, dilation];\n const conv2dDataFormat =
'NHWC';\n\n const res = conv2d(\n (input4D as Tensor4D), (filter4D as Tensor4D), strides, pad,\n conv2dDataFormat, dilations, dimRoundingMode);\n\n if (reshapedTo3D) {\n return reshape(res, [res.shape[2],

```

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res.shape[3]]) as T;\n }\n\n return reshape(res, [res.shape[0],
res.shape[2], res.shape[3]]) as T;\n}\n\nexport const conv1d = op({conv1d_});\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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```

=====
*\nimport {ENGINE} from './engine';\nimport {Conv2DBackpropInput, Conv2DBackpropInputAttrs,
Conv2DBackpropInputInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from
 './util';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
 './reshape';\n\n/**\n * Computes the derivative of the input of a 2D convolution.\n * @param xShape The shape
of the input: [batch, height, width, inDepth].\n * If length of 3, batch of 1 is assumed.\n * @param dy The derivative
of the output, of rank 4 or rank 3 of shape\n * `[batch, outHeight, outWidth, outDepth]`. If rank 3, batch of 1 is\n *
assumed.\n * @param filter The filter, rank 4, of shape\n * `[filterHeight, filterWidth, inDepth, outDepth]`. \n *
@param strides The strides of the convolution: `[strideHeight,\n * strideWidth]`. \n * @param pad The type of
padding algorithm used:\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter
size.\n * - `valid`: output will be smaller than input if
filter is larger\n * than 1x1.\n * @param dataFormat: An optional string from: \"NHWC\", \"NCHW\". Defaults
to\n * \"NHWC\". Specify the data format of the input and output data. With the\n * default format \"NHWC\",
the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dimRoundingMode A string
from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\nfunction
conv2DBackpropInput_<T extends Tensor3D|Tensor4D>(\n xShape: [number, number, number,
number]|[number, number, number], dy: T,\n filter: Tensor4D, strides: [number, number]|[number,\n pad:
'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n
dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n util.assert(\n xShape.length === dy.rank,\n () => `Length of
inShape ` +\n `(${xShape.length}) and rank of dy (${dy.rank}) must match`);\n\n let xShape4D = xShape as
[number, number, number,
number];\n let dy4D = dy as Tensor4D;\n let reshapedTo4D = false;\n if (dy.rank === 3) {\n reshapedTo4D =
true;\n dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n xShape4D = [1, xShape[0], xShape[1],
xShape[2]];\n }\n\n util.assert(\n xShape4D.length === 4,\n () =>\n `Error in conv2dDerInput: inShape
must be length 4, but got length ` +\n ` ${xShape4D.length}.`);\n util.assert(\n dy4D.rank === 4,\n () =>
`Error in conv2dDerInput: dy must be rank 4, but got ` +\n `rank ${dy4D.rank}`);\n util.assert(\n filter.rank
=== 4,\n () => `Error in conv2dDerInput: filter must be rank 4, but got ` +\n `rank ${filter.rank}`);\n const
inDepth = dataFormat === 'NHWC' ? xShape4D[3] : xShape4D[1];\n const outDepth = dataFormat === 'NHWC' ?
dy4D.shape[3] : dy4D.shape[1];\n util.assert(\n inDepth === filter.shape[2],\n () => `Error in
conv2dDerInput: depth of input (${inDepth}) must ` +\n
`match input depth for filter ${filter.shape[2]}.`);\n util.assert(\n outDepth === filter.shape[3],\n () =>
`Error in conv2dDerInput: depth of output (${outDepth}) must ` +\n `match output depth for filter
${filter.shape[3]}.`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () =>
`Error in conv2dDerInput: pad must be an integer when using, ` +\n `dimRoundingMode
${dimRoundingMode} but got pad ${pad}.`);\n }\n\n const inputs: Conv2DBackpropInputInputs = {dy: dy4D,
filter};\n\n const attrs: Conv2DBackpropInputAttrs =\n {strides, pad, dataFormat, dimRoundingMode,
inputShape: xShape4D};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res =
ENGINE.runKernel(\n Conv2DBackpropInput, inputs as {} as NamedTensorMap,\n attrs as {}
as NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]])

```

as T;\n } \n return res;\n } \n\nexport const conv2DBackpropInput = op({conv2DBackpropInput\_});\n"/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport {op} from './operation';\n\n/**\n * Computes the transposed 2D convolution of an image, also known as a\n * deconvolution.\n * @param x The input image, of rank 4 or rank 3, of shape\n * `[batch, height, width, inDepth]`. If rank 3, batch of 1 is assumed.\n * @param filter The filter, rank 4, of shape\n * `[filterHeight, filterWidth, outDepth, inDepth]`. \n * `inDepth` must match `inDepth` in `x`.\n * @param outputShape Output shape, of rank 4 or rank 3:\n * `[batch, height, width, outDepth]`. If rank 3, batch of 1 is assumed.\n * @param strides The strides of the original convolution:\n * `[strideHeight, strideWidth]`.\n * @param pad The type of padding algorithm used in the non-transpose version\n * of the op.\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv2dTranspose_<T\n extends Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor4D|TensorLike,\n outputShape: [number, number, number, number]|[number, number, number],\n strides: [number, number]|number, pad:\n 'valid'|'same'|number,\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x', 'conv2dTranspose');\n const $filter = convertToTensor(filter, 'filter', 'conv2dTranspose');\n return conv2DBackpropInput(\n outputShape, $x, $filter, strides, pad, 'NHWC', dimRoundingMode);\n}\n\nexport\nconst conv2dTranspose = op({conv2dTranspose_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Conv3D, Conv3DAttrs, Conv3DInputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor4D, Tensor5D} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {eitherStridesOrDilationsAreOne} from './conv_util';\nimport {op} from './operation';\nimport {reshape} from\n './reshape';\n\n/**\n * Computes a 3D convolution over the input x.\n * @param x The input tensor, of rank 5 or\n * rank 4, of shape\n * `[batch, depth, height, width, channels]`. If rank 4,\n * batch\n * of 1 is assumed.\n * @param filter The filter, rank 5, of shape\n * `[filterDepth, filterHeight, filterWidth,\n inChannels, outChannels]`. \n * `inChannels` must match between input and filter.\n * @param strides The strides\n * of the convolution: `[strideDepth, strideHeight,\n * strideWidth]`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output\n * will be smaller than input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat: An optional string from:\n * "NDHWC", "NCDHW". Defaults to\n * "NDHWC". Specify the data format of the input and output data.
```



With the default format "NDHWC", the data is stored in the order of: [batch, depth, height, width, channels].

Only "NDHWC" is currently supported. @param dilations The dilation rates: [dilationDepth, dilationHeight, dilationWidth] in which we sample input values across the height and width dimensions in atrous convolution. Defaults to [1, 1, 1]. If dilations is a single number, then dilationDepth == dilationHeight == dilationWidth. If it is greater than 1, then all values of strides must be 1. @doc {heading: 'Operations', subheading: 'Convolution'}\nfunction conv3d<T extends Tensor4D|Tensor5D>(x: T|TensorLike, filter: Tensor5D|TensorLike, strides: [number, number, number]|number, pad: 'valid'|'same', dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC', dilations: [number, number, number]|number = [1, 1, 1]): T {\n const \$x = convertToTensor(x, 'x', 'conv3d');\n const \$filter = convertToTensor(filter, 'filter', 'conv3d');\n let x5D = \$x as Tensor5D;\n let reshapedTo5D = false;\n if (\$x.rank === 4) {\n reshapedTo5D = true;\n x5D = reshape(\$x, [1, \$x.shape[0], \$x.shape[1], \$x.shape[2], \$x.shape[3]]);\n }\n util.assert(x5D.rank === 5, () => `Error in conv3d: input must be rank 5, but got rank \${x5D.rank}.`);\n util.assert(\$filter.rank === 5, () => `Error in conv3d: filter must be rank 5, but got rank ` +\n `\${\$filter.rank}.`);\n util.assert(x5D.shape[4] === \$filter.shape[3], () => `Error in conv3d: depth of input (\$x5D.shape[4]) must match ` +\n `input depth for filter \${\$filter.shape[3]}.`);\n util.assert(eitherStridesOrDilationsAreOne(strides, dilations), () => `Error in conv3D: Either strides or dilations must be 1. ` +\n `Got strides \${strides} and dilations '\${dilations}'`);\n util.assert(dataFormat === 'NDHWC', () => `Error in conv3d: got dataFormat of \${\n dataFormat} but only NDHWC is currently supported.`);\n const inputs: Conv3DInputs = {x: x5D, filter: \$filter};\n const attrs: Conv3DAttrs = {strides, pad, dataFormat, dilations};\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Conv3D, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n if (reshapedTo5D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as T;\n }\n return res;\n}\n\nexport const conv3d = op({conv3d\_});\n"/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,\n \* either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====\n*\nimport {ENGINE} from '../engine';\nimport {Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs, Conv3DBackpropInputV2Inputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor4D, Tensor5D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport * as util from '../util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the derivative of the input of a 3D convolution.\n * @param xShape The shape of the input: [batch, depth, height, width, in_channels]. If length of 4, batch of 1 is assumed.\n * @param dy The derivative of the output, of rank 5 or rank 4 of shape [batch, outDepth, outHeight, outWidth, in_channels].\n * If rank 4, batch of 1 is assumed.\n * @param filter The filter, rank 5, of shape [filterDepth, filterHeight, filterWidth, inDepth, outDepth].\n * @param strides The strides of the convolution: [strideDepth, strideHeight, strideWidth].\n * @param pad The type of padding algorithm used: 'same' and stride 1: output will be of same size as input, regardless of filter size. 'valid': output will be smaller than input if filter is larger than 1x1.\n */\nfunction conv3DBackpropInput<T extends Tensor4D|Tensor5D>(xShape: [number, number, number, number, number]|number, dy: T, filter: Tensor5D, strides: [number, number, number]|number, pad: 'valid'|'same'): T {\n util.assert(xShape.length === dy.rank, () => `Length of
```

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inShape ` +\n `(${xShape.length}) and rank of dy (${dy.rank}) must match`);\n\n let xShape5D = xShape as
[number, number, number, number, number];\n let dy5D = dy as Tensor5D;\n
 let reshapedTo5D = false;\n if (dy.rank === 4) {\n reshapedTo5D = true;\n dy5D = reshape(dy, [1,
dy.shape[0], dy.shape[1], dy.shape[2], dy.shape[3]]);\n xShape5D = [1, xShape[0], xShape[1], xShape[2],
xShape[3]];\n }\n\n const inDepth = xShape5D[4];\n const outDepth = dy5D.shape[4];\n util.assert(\n
xShape5D.length === 5,\n () =>\n `Error in conv3dDerInput: inShape must be length 5, but got length ` +\n
 `${xShape5D.length}`);\n util.assert(\n dy5D.rank === 5,\n () => `Error in conv3dDerInput: dy must be
rank 5, but got ` +\n `rank ${dy5D.rank}`);\n util.assert(\n filter.rank === 5,\n () => `Error in
conv3dDerInput: filter must be rank 5, but got ` +\n `rank ${filter.rank}`);\n util.assert(\n inDepth ===
filter.shape[3],\n () => `Error in conv3dDerInput: depth of input (${inDepth}) must ` +\n `match input
depth for filter ${filter.shape[3]}.`);\n util.assert(\n outDepth === filter.shape[4],\n () => `Error in conv3dDerInput: depth of output (${outDepth}) must ` +\n `match output depth for filter
${filter.shape[4]}.`);\n\n const inputs: Conv3DBackpropInputV2Inputs = {dy: dy5D, filter};\n const attrs:\n Conv3DBackpropInputV2Attrs = {pad, strides, inputShape: xShape5D};\n // tslint:disable-next-line: no-
unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Conv3DBackpropInputV2, inputs as {\n
as NamedTensorMap,\n attrs as {} as NamedAttrMap as T;\n\n if (reshapedTo5D) {\n return
reshape(\n res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]] as\n T;\n }\n } return
res;\n }\n\n export const conv3DBackpropInput = op({conv3DBackpropInput_});\n /**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain
a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {Tensor4D, Tensor5D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {conv3DBackpropInput} from './conv3d_backprop_input';\nimport {op}
from './operation';\n\n/**\n * Computes the transposed 3D convolution of a volume, also known as a\n *
deconvolution.\n * @param x The input image, of rank 5 or rank 4, of shape\n * `[batch, depth, height, width,
inDepth]`. If rank 4, batch of 1 is assumed.\n * @param filter The
filter, rank 4, of shape\n * `[depth, filterHeight, filterWidth, outDepth, inDepth]`. \n * `inDepth` must match
`inDepth` in `x`.\n * @param outputShape Output shape, of rank 5 or rank 4:\n * `[batch, depth, height, width,
outDepth]`. If rank 3, batch of 1 is\n * assumed.\n * @param strides The strides of the original convolution:\n *
`[strideDepth, strideHeight, strideWidth]`.\n * @param pad The type of padding algorithm used in the non-
transpose version\n * of the op.\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction
conv3dTranspose_<T extends Tensor4D|Tensor5D>(\n x: T|TensorLike, filter: Tensor5D|TensorLike,\n outputShape:\n [number, number, number, number, number],[number, number, number, number],\n strides: [number, number, number]number, pad: 'valid'|'same'): T {\n const $x = convertToTensor(x, 'x',
'conv3dTranspose');\n const $filter = convertToTensor(filter, 'filter', 'conv3dTranspose');\n\n return
conv3DBackpropInput(outputShape, $x, $filter, strides, pad);\n}\n\nexport const conv3dTranspose =
op({conv3dTranspose_});\n /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
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*\n\nimport {ENGINE} from './engine';\nimport {Cos, CosInputs} from './kernel_names';\nimport {Tensor} from
'./tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes cos of the input `tf.Tensor` element-wise:
`cos(x)`\n *\n * ``js\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\n *\n * x.cos().print(); // or
tf.cos(x)\n * ``\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
*\n\nfunction cos_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'cos');\n\n const
inputs: CosInputs = {x: $x};\n\n return ENGINE.runKernel(Cos, inputs as { } as NamedTensorMap);\n}\n\nexport
const cos = op({cos_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====
*\n\nimport {ENGINE} from './engine';\nimport {Cosh, CoshInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
hyperbolic cos of the input `tf.Tensor` element-wise: `cosh(x)`\n *\n * ``js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n
*\n * x.cosh().print(); // or tf.cosh(x)\n * ``\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\n\nfunction
cosh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'cosh');\n\n const inputs:
CoshInputs = {x: $x};\n\n return ENGINE.runKernel(Cosh, inputs as { } as NamedTensorMap);\n}\n\nexport const
cosh = op({cosh_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====
*\n\nimport {ENGINE} from './engine';\nimport
{Cumsum, CumsumAttrs, CumsumInputs} from './kernel_names';\nimport {NamedAttrMap} from
'./kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from
'./operation';\n\n/**\n * Computes the cumulative sum of a `tf.Tensor` along `axis`.\n *\n * ``js\n * const x =
tf.tensor([1, 2, 3, 4]);\n *\n * x.cumsum().print();\n * ``\n *\n * const x = tf.tensor([[1, 2], [3, 4]]);\n *\n
x.cumsum().print();\n * ``\n *\n * @param x The input tensor to be summed.\n *\n * @param axis The axis along
which to sum. Optional. Defaults to 0.\n *\n * @param exclusive Whether to perform exclusive cumulative sum.
Optional.\n * Defaults to false. If set to true then the sum of each tensor entry\n * does not include its own
value, but only the values previous to it\n * along the specified axis.\n *\n * @param reverse Whether to sum in the
opposite direction. Optional.\n * Defaults to false.\n *\n * @doc {heading: 'Operations', subheading: 'Scan'}\n
*\n\nfunction cumsum_<T extends Tensor>(x: Tensor|TensorLike, axis = 0, exclusive = false, reverse = false): T
{\n const $x = convertToTensor(x, 'x', 'cumsum');\n\n const inputs: CumsumInputs = {x: $x};\n\n const attrs:
CumsumAttrs = {axis, exclusive, reverse};\n\n return ENGINE.runKernel(\n Cumsum, inputs as { } as
NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const cumsum = op({cumsum_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version

```





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* https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dilations The dilation rates:
`[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n *
in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single\n * number, then `dilationHeight ==
dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n * @param dataFormat: An
optional string from: `\"NHWC\"`, `\"NCHW\"`. Defaults to\n
* `\"NHWC\"`. Specify the data format of the input and output data. With the\n * default format `\"NHWC\"`, the
data is stored in the order of: [batch,\n * height, width, channels]. Only `\"NHWC\"` is currently supported.\n *
@param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to
truncate.\n * \n * @doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction depthwiseConv2d_<T
extends Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor4D|TensorLike,\n strides: [number,
number]|number, pad: 'valid'|'same'|number,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dilations: [number,
number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x',
'depthwiseConv2d');\n const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');\n let x4D = $x as
Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x,
[1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in
depthwiseConv2d: input must be rank 4, but got ` +\n `rank ${x4D.rank}.`);\n util.assert(\n $filter.rank
=== 4,\n () => `Error in depthwiseConv2d: filter must be rank 4, but got rank ` +\n ` ${$filter.rank}.`);\n
util.assert(\n x4D.shape[3] === $filter.shape[2],\n () => `Error in depthwiseConv2d: number of input channels
` +\n ` (${x4D.shape[3]}) must match the inChannels dimension in ` +\n ` filter ${$filter.shape[2]}.`);\n
if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in
depthwiseConv2d: pad must be an integer when using, ` +\n ` dimRoundingMode ${dimRoundingMode} but
got pad ${pad}.`);\n }\n\n const inputs: DepthwiseConv2dNativeInputs = {x: x4D, filter: $filter};\n const attrs:
DepthwiseConv2dNativeAttrs =\n {strides, pad, dataFormat,
dilations, dimRoundingMode};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res =
ENGINE.runKernel(\n DepthwiseConv2dNative, inputs as {} as NamedTensorMap,\n attrs as
{} as NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2],
res.shape[3]]) as T;\n }\n return res;\n}\n\nexport const depthwiseConv2d = op({depthwiseConv2d_});\n"/**\n *
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copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Diag, DiagInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\n\nimport {op} from './operation';\n\n/**\n * Returns a diagonal tensor with a given diagonal
values.\n * \n * Given a diagonal, this operation returns a tensor with the diagonal and\n * everything else padded
with zeros.\n * \n * Assume the input has dimensions `[D1,..., Dk]`, then the output is a tensor\n * of rank 2k with
dimensions `[D1,..., Dk, D1,..., Dk]`\n * \n * ```\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * \n * tf.diag(x).print()\n *
```\n * ```\n * const x = tf.tensor1d([1, 2, 3, 4, 5, 6, 6, 8], [4, 2]);\n * \n * tf.diag(x).print()\n *
```\n * \n * @param x The
input tensor.\n *\nfunction diag_(x:
Tensor): Tensor {\n const $x = convertToTensor(x, 'x', 'diag');\n\n const inputs: DiagInputs = {x: $x};\n\n return
ENGINE.runKernel(Diag, inputs as {} as NamedTensorMap);\n}\n\nexport const diag = op({diag_});\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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```

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
See the License for the specific language governing permissions and  
limitations under the License.

```
=====
*/n\nimport {ENGINE} from './engine';\nimport {Dilation2D, Dilation2DAttrs,\nDilation2DInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D,\nTensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from\n './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the grayscale dilation over the input `x`.\n * @param x The input tensor, rank 3 or rank 4 of shape\n * `[batch, height, width, inChannels]`. If rank 3, batch\n * of 1 is assumed.\n * @param filter The filter tensor, rank 3, of shape\n * `[filterHeight, filterWidth, depth]`.\n * @param strides The strides of the sliding window for each dimension of the\n * input tensor: `[strideHeight,\n * strideWidth]`. If `strides` is a single number,\n * then `strideHeight == strideWidth`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output\n * will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if\n * filter is larger\n * than 1*1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat Specify the data format of\n * the input and output data.\n * Defaults to 'NHWC'. Only 'NHWC' is currently supported. With the\n * default\n * format "NHWC", the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dilations\n * The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and\n * width dimensions\n * for atrous morphological dilation. Defaults to `[1, 1]`. If `dilations`\n * is a single\n * number, then `dilationHeight == dilationWidth`. If it is\n * greater than 1, then all values of `strides` must be 1.\n * @doc\n *\n * {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction dilation2d<T extends Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor3D|TensorLike,\n strides: [number, number]|number, pad: 'valid'|'same',\n dilations: [number, number]|number = [1, 1],\n dataFormat: 'NHWC' = 'NHWC'): T {\n const $x =\n convertToTensor(x, 'x', 'dilation2d');\n const $filter = convertToTensor(filter, 'filter', 'dilation2d');\n util.assert(\n $x.rank === 3 || $x.rank === 4,\n () => `Error in dilation2d: input must be rank 3 or 4, but got rank ` +\n `${$x.rank}`);\n util.assert(\n $filter.rank === 3,\n () => `Error in dilation2d: filter must be rank 3, but got\n rank ` +\n `${$filter.rank}`);\n util.assert(\n dataFormat === 'NHWC',\n () => `Error in dilation2d:\n Only NHWC is currently supported, ` +\n `but got dataFormat of ${dataFormat}`);\n let x4D = $x as\n Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n reshapedTo4D = true;\n }\n const inputs:\n Dilation2DInputs = {x: x4D, filter: $filter};\n const attrs: Dilation2DAttrs = {strides, pad, dilations};\n //\n tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Dilation2D,\n inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n return res;\n}\n\nexport const dilation2d\n = op({dilation2d});\n\n",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed\n * under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF\n * ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n * Returns the dimensions in the input shape that are broadcasted to\n * produce the provided output\n * shape.\n * The returned dimensions are 0-indexed and sorted. An example:\n * inShape = [4, 1, 3]\n * outShape
```

```

= [5, 4, 3, 3]\n * result = [1]. Dimension 1 (2nd dimension of input) gets broadcasted 1 => 3.\n */\nexport function
getBroadcastDims(\n inShape: number[], outShape: number[]): number[] {\n const inRank = inShape.length;\n const dims: number[] = [];\n for (let i = 0; i < inRank; i++) {\n const dim = inRank - 1 - i;\n const a =
inShape[dim] || 1;\n const b = outShape[outShape.length - 1 - i] || 1;\n if (b > 1 && a === 1)
{\n dims.unshift(dim);\n }\n }\n return dims;\n}\n\n/**\n * Returns the axes in the output space that should be
reduced to produce\n * the input space.\n */\nexport function getReductionAxes(\n inShape: number[], outShape:
number[]): number[] {\n const result: number[] = [];\n for (let i = 0; i < outShape.length; i++) {\n const inDim =
inShape[inShape.length - i - 1];\n const outAxis = outShape.length - i - 1;\n const outDim =
outShape[outAxis];\n if (inDim === null || (inDim === 1 && outDim > 1)) {\n result.unshift(outAxis);\n }\n }\n return result;\n}\n\nexport function assertAndGetBroadcastShape(\n shapeA: number[], shapeB: number[]):
number[] {\n const result: number[] = [];\n const l = Math.max(shapeA.length, shapeB.length);\n for (let i = 0; i
< l; i++) {\n let a = shapeA[shapeA.length - i - 1];\n if (a === null) {\n a = 1;\n }\n let b =
shapeB[shapeB.length - i - 1];\n if (b === null) {\n b = 1;\n }\n if
(a === 1) {\n result.unshift(b);\n } else if (b === 1) {\n result.unshift(a);\n } else if (a !== b) {\n const
errMsg = `Operands could not be broadcast together with shapes ` +\n `${shapeA} and ${shapeB}`;\n throw Error(errMsg);\n } else {\n result.unshift(a);\n }\n }\n return result;\n}\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====\n
*/\nimport {ENGINE} from './engine';\nimport {Equal, EqualInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth
value of (a == b) element-wise. Supports broadcasting.\n */\nexport const equal = (a: TensorLike, b: TensorLike):
boolean {\n const a = tf.tensor1d([1, 2, 3]);\n const b =
tf.tensor1d([2, 2, 2]);\n a.equal(b).print();\n}\n\n@param a The first input tensor.\n@param b The
second input tensor. Must have the same dtype as `a`.\n@doc {heading: 'Operations', subheading: 'Logical'}\n\n
function equal_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =
convertToTensor(a, 'a', 'equal');\n let
$b = convertToTensor(b, 'b', 'equal');\n [$a, $b] = makeTypesMatch($a, $b);\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: EqualInputs = {a: $a, b: $b};\n return
ENGINE.runKernel(Equal, inputs as {} as NamedTensorMap);\n}\n\nexport const equal = op({equal_});\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====\n
*/\nimport {ENGINE} from './engine';\nimport {Select, SelectInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert, assertShapesMatch} from
'./util';\nimport {broadcastTo} from './broadcast_to';\nimport {assertAndGetBroadcastShape} from
'./broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the elements, either `a` or `b` depending on the
`condition`.\n */\nexport const select = (a: TensorLike, b: TensorLike, condition: TensorLike): TensorLike {\n const cond =

```



```

tf.tensor1d([false, false, true], 'bool');\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([-1, -2, -3]);\n *\n * a.where(cond, b).print();\n * ```\n * @param condition The input condition. Must be of dtype bool.\n * @param a If `condition` is rank 1, `a` may have a higher rank but\n * its first dimension\n * must match the size of `condition`.\n * @param b A tensor with the same dtype as `a` and with shape that is\n * compatible with `a`.\n * @return A tensor with same dtype as `a` and `b`, and shape that is\n * broadcastable\n * from `a` and `b`.\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\nfunction where_<T extends\nTensor>(\n condition: Tensor|TensorLike, a: T|TensorLike, b: T|TensorLike): T {\n const $a =\n convertToTensor(a, 'a', 'where');\n const $b = convertToTensor(b, 'b', 'where');\n const $condition =\n convertToTensor(condition, 'condition', 'where', 'bool');\n // TODO: move this logic to forward function when the\n broadcastTo op is\n // implemented in WASM.\n // Find the broadcastable shape for $a and $b.\n const\n broadcastShape = assertAndGetBroadcastShape($a.shape, $b.shape);\n const $broadcastedA = broadcastTo($a,\n broadcastShape);\n const $broadcastedB = broadcastTo($b, broadcastShape);\n if ($condition.rank === 1) {\n //\n If condition rank is\n 1, then the first dimension must match the size of\n // condition.\n assert(\n $condition.shape[0] ===\n $a.shape[0],\n () => 'The first dimension of `a` must match the size of `condition`.');\n }\n if ($condition.rank\n !== 1) {\n // A must have the same shape as condition.\n assertShapesMatch(\n $condition.shape,\n $broadcastedB.shape, 'Error in where: '); \n }\n const inputs: SelectInputs = {\n condition: $condition,\n t:\n $broadcastedA,\n e: $broadcastedB\n };\n return ENGINE.runKernel(Select, inputs as unknown as\n NamedTensorMap);\n }\n \nexport const where = op({ where_ });\n "/**\n * @license\n * Copyright 2018 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n *\n import {ENGINE} from './engine';\n import {ZerosLike, ZerosLikeInputs} from './kernel_names';\n import\n {Tensor} from './tensor';\n import {NamedTensorMap} from './tensor_types';\n import {convertToTensor} from\n './tensor_util_env';\n import {TensorLike} from './types';\n import {op} from './operation';\n \n /**\n * Creates a\n * `tf.Tensor` with all elements set to 0 with the same shape as the\n * given tensor.\n * ```\n * const x =\n tf.tensor([1, 2]);\n * tf.zerosLike(x).print();\n * ```\n * @param x The tensor of required shape.\n * @doc\n {heading: 'Tensors', subheading: 'Creation'}\n *\n function zerosLike_<T extends Tensor>(x:\n T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'zerosLike');\n const inputs: ZerosLikeInputs = {x: $x};\n return ENGINE.runKernel(ZerosLike, inputs as { } as NamedTensorMap);\n }\n \n export const zerosLike =\n op({zerosLike_});\n "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *\n =====\n *\n import {Tensor} from './tensor';\n import\n {makeTypesMatch} from './tensor_util';\n import {convertToTensor} from './tensor_util_env';\n import\n {TensorLike} from './types';\n import {div} from './div';\n import {equal} from './equal';\n import {op} from\n './operation';\n import {where} from './where';\n import {zerosLike} from './zeros_like';\n \n /**\n * Divides two\n * `tf.Tensor`s element-wise, A / B. Supports broadcasting. Return 0\n * if denominator is 0.\n * ```\n * const\n a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n * const c = tf.tensor1d([0, 0, 0, 0]);\n * ```\n */

```

```
a.divNoNaN(b).print(); // or tf.divNoNaN(a, b)\n * a.divNoNaN(c).print(); // or tf.divNoNaN(a, c)\n * ```\n *\n * ``js\n * // Broadcast div a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(2);\n * const c =\n * tf.scalar(0);\n * \n * a.divNoNaN(b).print(); // or tf.divNoNaN(a, b)\n * a.divNoNaN(c).print(); // or tf.divNoNaN(a,\n * c)\n * ```\n *\n * @param a The first tensor as the numerator.\n * @param b
```

The second tensor as the denominator. Must have the same dtype as `a``.  
`@doc {heading: 'Operations', subheading: 'Arithmetic'}`

```
\n * \nfunction divNoNaN<T extends Tensor>(\n * a: Tensor|TensorLike, b:\n * Tensor|TensorLike): T {\n * // TODO: Make this into its own kernel.\n * let $a = convertToTensor(a, 'a', 'div');\n * let\n * $b = convertToTensor(b, 'b', 'div');\n * [$a, $b] = makeTypesMatch($a, $b);\n * \n * const divResult = div($a, $b);\n * \n * const zeros = zerosLike(divResult);\n * const bEqualsZero = equal($b, zeros);\n * return where(bEqualsZero, zeros,\n * divResult) as T;\n * }\n *\n * \nexport const divNoNaN = op({divNoNaN_});\n *,"/>\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n
```

\* distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====\n *\n *\n * \n\nimport {Tensor,} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}\nfrom './types';\nimport * as util from './util';\n\nimport {matMul} from './mat_mul';\nimport {op} from\n './operation';\nimport {reshape} from './reshape';\n\n/>\n * Computes the dot product of two matrices and/or\n * vectors, `t1` and `t2`.\n * ```\n *\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor2d([[1, 2], [3, 4]]);\n * \n * const c = tf.tensor2d([[1, 2, 3], [4, 5, 6]]);\n * \n * a.dot(b).print(); // or tf.dot(a, b)\n * b.dot(a).print();\n * \n * b.dot(c).print();\n * ```\n *\n * @param t1 The first tensor in the dot operation.\n * \n *
```

```
@param t2 The second tensor in the dot operation.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n *\n * \nfunction dot_(t1: Tensor|TensorLike, t2: Tensor|TensorLike): Tensor {\n * const $t1 = convertToTensor(t1, 't1',\n * 'dot');\n * const $t2 = convertToTensor(t2, 't2', 'dot');\n * \n * util.assert(\n * ($t1.rank === 1 || $t1.rank === 2) &&\n * ($t2.rank === 1 || $t2.rank === 2),\n * () => `Error in dot: inputs must all be rank 1 or 2, but got ranks ` +\n * \n * `${$t1.rank} and ${$t2.rank}.`);\n * \n * const t1Inner = ($t1.rank === 1 ? $t1.size : $t1.shape[1]);\n * const t2Inner =\n * ($t2.rank === 1 ? $t2.size : $t2.shape[0]);\n * \n * util.assert(\n * t1Inner === t2Inner,\n * () => `Error in dot: inner\n * dimensions of inputs must match, but got ` +\n * \n * `${t1Inner} and ${t2Inner}.`);\n * \n * if ($t1.rank === 1 &&\n * $t2.rank === 1) {\n * const t12D = reshape($t1, [1, -1]);\n * const t22D = reshape($t2, [-1, 1]);\n * const t1t2 =\n * matMul(t12D, t22D);\n * return reshape(t1t2, []);\n * } else if ($t1.rank === 1 && $t2.rank === 2) {\n * const t12D = reshape($t1, [1, -1]);\n * const t22D = reshape($t2,\n * [$t2.shape[0], $t2.shape[1]]);\n * const t1t2 = matMul(t12D, t22D);\n * return reshape(t1t2, [t1t2.size]);\n * } else if\n * ($t1.rank === 2 && $t2.rank === 1) {\n * const t22D = reshape($t2, [-1, 1]);\n * const t1t2 = matMul($t1, t22D);\n * return reshape(t1t2, [t1t2.size]);\n * } else {\n * const t22D = reshape($t2, [$t2.shape[0], $t2.shape[1]]);\n * const\n * t1t2 = matMul($t1, t22D);\n * return t1t2;\n * }\n * }\n *\n * \nexport const dot = op({dot_});\n *,"/>\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on
```

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```
=====\n *\n *\n * \n\nimport {ENGINE} from './engine';\nimport {Elu, EluInputs} from './kernel_names';\nimport {Tensor} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
```

```

./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes exponential linear element-wise: $x > 0 ? e^x - 1 : 0$.

\n * const x = tf.tensor1d([-1, 1, -3, 2]);\n * x.elu().print(); // or tf.elu(x)

\n * @param x The input tensor.

\n * @doc {heading: 'Operations', subheading: 'Basic math'}

\n * \nfunction elu<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'elu');\n const inputs: EluInputs = {x: $x};\n return ENGINE.runKernel(Elu, inputs as {} as NamedTensorMap);\n}\n\nexport const elu = op({elu_});\n", /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Erf, ErfInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Computes gause error function of the input tf.Tensor element-wise:

\n * $\text{erf}(x)$

\n * const x = tf.tensor1d([0, .1, -.1, .7]);\n * x.erf().print(); // or tf.erf(x)

\n * @param x The input tensor.

\n * @doc {heading: 'Operations', subheading: 'Basic math'}

\n * \nfunction erf<T extends Tensor>(x: T|TensorLike): T {\n let $x = convertToTensor(x, 'x', 'erf');\n util.assert(($x.dtype === 'int32' || $x.dtype === 'float32')\n () => 'Input dtype must be `int32` or `float32`.');\n if ($x.dtype === 'int32') {\n $x = cast($x, 'float32');\n }\n const inputs: ErfInputs = {x: $x};\n return ENGINE.runKernel(Erf, inputs as {} as NamedTensorMap);\n}\n\nexport const erf = op({erf_});\n", /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Exp, ExpInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes exponential of the input tf.Tensor element-wise.

\n * e^x

\n * const x = tf.tensor1d([1, 2, -3]);\n * x.exp().print(); // or tf.exp(x)

\n * @param x The input tensor.

\n * @doc {heading: 'Operations', subheading: 'Basic math'}

\n * \nfunction exp<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'exp');\n const inputs: ExpInputs = {x: $x};\n return ENGINE.runKernel(Exp, inputs as {} as NamedTensorMap);\n}\n\nexport const exp = op({exp_});\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {ENGINE} from './engine';\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Returns a
 `tf.Tensor` that has expanded rank, by inserting a dimension\n * into the tensor's shape.\n * \n * `js` \n * const x =
 tf.tensor1d([1, 2, 3, 4]);\n * const axis = 1;\n * x.expandDims(axis).print();\n * \n * \n * @param x The input
 tensor whose dimensions to be expanded.\n * @param axis The dimension index at which to insert shape of `1`.
 Defaults\n *

```

```

 to 0 (the first dimension).\n * \n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n *\nfunction
 expandDims_<T extends Tensor>(x: Tensor|TensorLike, axis = 0): T {\n const $x = convertToTensor(x, 'x',
 'expandDims', 'string_or_numeric');\n util.assert(axis <= $x.rank, () => 'Axis must be <= rank of the tensor');\n
 const inputs: ExpandDimsInputs = {input: $x};\n const attrs: ExpandDimsAttrs = {dim: axis};\n return
 ENGINE.runKernel(\n ExpandDims, inputs as { } as NamedTensorMap, attrs as { } as
 NamedAttrMap);\n}\n\nexport const expandDims = op({expandDims_});\n"/**\n * @license\n * Copyright 2018
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the

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License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
 KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
 limitations under the License.\n *

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=====
*\n\nimport {ENGINE} from './engine';\nimport {Expm1, Expm1Inputs} from './kernel_names';\nimport {Tensor}
 from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
 exponential of the input `tf.Tensor` minus one element-wise.\n * \n * `e ^ x - 1` \n * \n * `js` \n * const x =
 tf.tensor1d([1, 2, -3]);\n * x.expm1().print(); // or tf.expm1(x)\n * \n * \n * @param x The input tensor.\n * \n *
 @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction expm1_<T extends Tensor>(x: T|TensorLike): T {\n
 const $x =
 convertToTensor(x, 'x', 'expm1');\n const inputs: Expm1Inputs = {x: $x};\n return ENGINE.runKernel(Expm1,
 inputs as { } as NamedTensorMap);\n}\n\nexport const expm1 = op({expm1_});\n"/**\n * @license\n * Copyright 2020
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may
 not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {ENGINE} from './engine';\nimport {Tile, TileAttrs, TileInputs} from './kernel_names';\nimport
 {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
 * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Construct a tensor by repeating it the number of
 times given by reps.\n * \n * This operation creates a new tensor by replicating `input` `reps` \n * times. The output
 tensor's i'th dimension has `input.shape[i] *` \n * `reps[i]` elements, and the values of `input` are replicated \n *
 `reps[i]` times along the i'th dimension. For example, tiling \n * `[a, b, c, d]` by `[2]` produces `[a, b, c, d, a, b, c,
 d]`.\n * \n * `js` \n * const a = tf.tensor1d([1, 2]);\n * a.tile([2]).print(); // or a.tile([2])\n * \n * \n * \n *
 const a = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * a.tile([1, 2]).print(); // or a.tile([1, 2])\n * \n * \n * @param x The

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tensor to tile.\n * @param reps Determines
the number of replications per dimension.\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n
*/\nfunction tile_<T extends Tensor>(x: T|TensorLike, reps: number[]): T {\n const $x = convertToTensor(x, 'x',
'tile', 'string_or_numeric');\n util.assert(\n $x.rank === reps.length,\n () => `Error in transpose: rank of input
${$x.rank}` +\n `must match length of reps ${reps}.`);\n\n const inputs: TileInputs = {x: $x};\n const attrs:
TileAttrs = {reps};\n\n return ENGINE.runKernel(\n Tile, inputs as unknown as NamedTensorMap,\n attrs as unknown as NamedAttrMap);\n}\n\nexport const tile = op({tile_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {Tensor2D} from './tensor';\nimport {DataType} from './types';\nimport {buffer} from
'/buffer';\nimport {expandDims} from './expand_dims';\nimport {op} from './operation';\nimport {reshape} from
'/reshape';\nimport {tile} from './tile';\n\n/**\n * Create an identity matrix.\n *\n * @param numRows Number of
rows.\n * @param numColumns Number of columns. Defaults to `numRows`.\n * @param batchSize If provided,
will add the batch shape to the beginning\n * of the shape of the returned `tf.Tensor` by repeating the identity\n *
matrix.\n * @param dtype Data type.\n * @returns Identity matrix of
the specified size and data type, possibly\n * with batch repetition if `batchShape` is specified.\n *\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n */\nfunction eye_(\n numRows: number, numColumns?: number,\n batchSize?:\n [\n number\n]|[number, \n number]|[number, number, number]|[number,
number, number, number],\n dtype: DataType = 'float32'): Tensor2D {\n if (numColumns == null) {\n numColumns = numRows;\n }\n const buff = buffer([numRows, numColumns], dtype);\n const n = numRows <=
numColumns ? numRows : numColumns;\n for (let i = 0; i < n; ++i) {\n buff.set(1, i, i);\n }\n const out:
Tensor2D = reshape(buff.toTensor(), [numRows, numColumns]);\n if (batchShape == null) {\n return out;\n }\n else {\n if (batchShape.length === 1) {\n return tile(expandDims(out, 0), [batchShape[0], 1, 1]) as Tensor2D;\n }\n else if (batchShape.length === 2) {\n // tslint:disable-next-line:no-unnecessary-type-assertion\n return tile(\n expandDims(expandDims(out, 0), 0),\n [batchShape[0], batchShape[1], 1, 1])\n as Tensor2D;\n }\n else if (batchShape.length === 3) {\n // tslint:disable-next-line:no-unnecessary-type-assertion\n return tile(expandDims(expandDims(expandDims(out, 0), 0), 0), [\n batchShape[0],
batchShape[1], batchShape[2], 1, 1\n]) as Tensor2D;\n }\n else {\n throw new Error(\n `eye()\n currently supports only 1D and 2D` +\n `// tslint:disable-next-line:no-any\n `batchShapes, but received
${(batchShape as any).length}D.`);\n }\n }\n}\n\nexport const eye = op({eye_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {ENGINE} from './engine';\nimport {Fill, FillAttrs} from './kernel_names';\nimport {NamedAttrMap}
from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from
 './types';\n\n/**\n * Creates a `tf.Tensor` filled with a scalar value.\n *\n * ``js\n * tf.fill([2, 2], 4).print();\n * ``\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param value The scalar value to fill
the tensor with.\n * @param dtype The type of an element in the resulting tensor. Defaults to\n * 'float'.\n *\n * @doc {heading: 'Tensors',

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subheading: 'Creation')\n *\nfunction fill<R extends Rank>(\n shape: ShapeMap[R], value: number|string,\n dtype?: DataType): Tensor<R> {\n const attrs: FillAttrs = {shape, value, dtype};\n return\n ENGINE.runKernel(Fill, {}, attrs as {} as NamedAttrMap);\n}\n\n\nexport {fill};\n", "/*\n * @license\n * Copyright\n 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n

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=====\n
\nimport {ENGINE} from './engine';\nimport {Floor, FloorInputs} from './kernel_names';\nimport {Tensor}\n from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/\n * Computes\n floor of input `tf.Tensor` element-wise: `floor(x)`.\n *\n * ``js\n * const x = tf.tensor1d([1.6, 1.1, -3.3]);\n *\n * x.floor().print(); // or tf.floor(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations',\n subheading: 'Basic math'}\n *\nfunction floor<T extends Tensor>(x: T|TensorLike): T {\n const $x =\n convertToTensor(x, 'x', 'floor');\n const inputs: FloorInputs = {x: $x};\n return ENGINE.runKernel(Floor, inputs\n as {} as NamedTensorMap);\n}\n\n\nexport const floor = op({floor_});\n", "/*\n * @license\n * Copyright 2018\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may

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not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n

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=====\n
\nimport {ENGINE} from './engine';\nimport {GatherV2, GatherV2Attrs, GatherV2Inputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport\n {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport\n {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/\n * Gather slices from tensor `x`'s axis `axis`\n according\n to `indices`.\n *\n * ``js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * const indices = tf.tensor1d([1, 3, 3], 'int32');\n *\n * x.gather(indices).print();\n *\n * ``js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const indices =\n tf.tensor1d([1, 1, 0], 'int32');\n *\n * x.gather(indices).print();\n *\n * @param x The input tensor whose slices to\n be gathered.\n * @param indices The indices of the values to extract.\n * @param axis The axis over which to select\n values. Defaults to 0.\n * @param batchDims Optional. The number of batch dimensions. It must be less\n * than\n or equal to rank(indices). Defaults to 0.\n * The output tensor will have shape of\n * `x.shape[:axis] +\n indices.shape[batchDims:] + x.shape[axis + 1:]`\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and\n Joining'}\n *\nfunction gather<T extends Tensor>(\n x: T|TensorLike, indices: Tensor|TensorLike, axis = 0,\n batchDims = 0): T {\n const $x = convertToTensor(x, 'x',\n 'gather');\n const $indices = convertToTensor(indices, 'indices', 'gather', 'int32');\n const inputs: GatherV2Inputs\n = {x: $x, indices: $indices};\n const attrs: GatherV2Attrs = {axis, batchDims};\n return ENGINE.runKernel(\n GatherV2, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\n\nexport const gather =\n op({gather_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

```

implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*/\nimport {ENGINE} from './engine';\nimport {Greater, GreaterInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a > b) element-wise. Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n *\n * a.greater(b).print();\n * ```\n *\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction greater_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'greater');\n let $b = convertToTensor(b, 'b', 'greater');\n [$a, $b] = makeTypesMatch($a, $b);\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: GreaterInputs = {a: $a, b: $b};\n return ENGINE.runKernel(Greater, inputs as { } as NamedTensorMap);\n}\n\nexport const greater = op({greater_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {ENGINE} from './engine';\nimport {GreaterEqual, GreaterEqualInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a >= b) element-wise. Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n *\n * a.greaterEqual(b).print();\n * ```\n *\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction greaterEqual_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'greaterEqual');\n let $b = convertToTensor(b, 'b', 'greaterEqual');\n [$a, $b] = makeTypesMatch($a, $b);\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: GreaterEqualInputs = {a: $a, b: $b};\n return ENGINE.runKernel(GreaterEqual, inputs as { } as NamedTensorMap);\n}\n\nexport const greaterEqual = op({greaterEqual_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {ENGINE} from './engine';\nimport {Imag, ImagInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns the imaginary part of a complex (or real) tensor.\n *\n * Given a tensor input, this operation returns a tensor of type float that is\n * the imaginary part of each element in input considered as a complex number.\n * If input is real, a tensor
```

```

of all zeros is returned.\n *\n * ````js\n * const x = tf.complex([-2.25, 3.25], [4.75, 5.75]);\n * tf.imag(x).print();\n *
```\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\n\nfunction imag_<T extends Tensor>(input:
T|TensorLike): T {\n  const $input = convertToTensor(input, 'input', 'imag');\n\n  const inputs: ImagInputs = {input:
$input};\n  return
  ENGINE.runKernel(Imag, inputs as {} as NamedTensorMap);\n}\n\n\nexport const imag = op({imag_});\n"/**\n *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {IsFinite, IsFiniteInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from
'/operation';\n\n/**\n * Returns which elements of x are finite.\n *\n * ````js\n * const x = tf.tensor1d([NaN, Infinity,
-Infinity, 0, 1]);\n *\n * x.isFinite().print(); // or tf.isNaN(x)\n *\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n\nfunction isFinite_<T extends Tensor>(x: T|TensorLike): T
{\n  const $x = convertToTensor(x, 'x', 'isFinite');\n\n  const inputs: IsFiniteInputs = {x: $x};\n  return
  ENGINE.runKernel(IsFinite, inputs as {} as NamedTensorMap);\n}\n\n\nexport const isFinite =
op({isFinite_});\n"/**\n *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {IsInf, IsInfInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'/tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns
which elements of x are Infinity or -Infinity.\n *\n * ````js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n
*\n * x.isInf().print(); // or tf.isNaN(x)\n *\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\n\nfunction isInf_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
convertToTensor(x, 'x', 'isInf');\n\n  const inputs: IsInfInputs = {x: $x};\n  return ENGINE.runKernel(IsInf,
inputs as {} as
NamedTensorMap);\n}\n\n\nexport const isInf = op({isInf_});\n"/**\n *\n * @license\n * Copyright 2018 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE}
from './engine';\nimport {IsNan, IsNanInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns which elements of x are NaN.\n *\n *
````js\n * const x = tf.tensor1d([NaN, NaN, NaN]);\n *\n * x.isNaN().print();\n *\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n\nfunction isNan_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
convertToTensor(x, 'x', 'isNan');\n\n const inputs: IsNanInputs = {x: $x};\n return ENGINE.runKernel(IsNan,
inputs as {} as
NamedTensorMap);\n}\n\n\nexport const isNan = op({isNan_});\n"/**\n *\n * @license\n * Copyright 2018 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====

```



```

*\n * ```\js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n *\n * x.isNaN().print(); // or tf.isNaN(x)\n *
```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction
isNaN_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isNaN');\n  const inputs:
IsNanInputs = {x: $x};\n\n  return ENGINE.runKernel(IsNan, inputs as { } as NamedTensorMap);\n}\n\nexport const
isNaN = op({isNaN_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-
2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport {LeakyRelu, LeakyReluAttrs, LeakyReluInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes leaky rectified linear element-
wise.\n *\n * See\n * [http://web.stanford.edu/~awni/papers/relu_hybrid_icml2013_final.pdf](\n
* http://web.stanford.edu/~awni/papers/relu_hybrid_icml2013_final.pdf)\n *\n * ```\js\n * const x = tf.tensor1d([-
1, 2, -3, 4]);\n *\n * x.leakyRelu(0.1).print(); // or tf.leakyRelu(x, 0.1)\n *
```\n * @param x The input tensor.\n *\n * @param alpha The scaling factor for negative values, defaults to 0.2.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\nfunction leakyRelu_<T extends Tensor>(x: T|TensorLike, alpha = 0.2): T {\n const
$x = convertToTensor(x, 'x', 'leakyRelu');\n\n const inputs: LeakyReluInputs = {x: $x};\n const attrs:
LeakyReluAttrs = {alpha};\n\n return ENGINE.runKernel(\n LeakyRelu, inputs as { } as NamedTensorMap,
attrs as { } as NamedAttrMap);\n}\n\n\nexport const leakyRelu = op({leakyRelu_});\n", "/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-
2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport {Less, LessInputs} from './kernel_names';\nimport {Tensor} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth
value of (a < b) element-wise.

```

```

Supports broadcasting.\n *\n * ```\js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n *\n *
a.less(b).print();\n *
```\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the
same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\nfunction less_<T extends
Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'less');\n  let $b =
convertToTensor(b, 'b', 'less');\n  [$a, $b] = makeTypesMatch($a, $b);\n\n  assertAndGetBroadcastShape($a.shape,
$b.shape);\n\n  const inputs: LessInputs = {a: $a, b: $b};\n\n  return ENGINE.runKernel(Less, inputs as { } as
NamedTensorMap);\n}\n\n\nexport const less = op({less_});\n", "/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT

```

WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {LessEqual, LessEqualInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a <= b) element-wise. Supports broadcasting.\n *\n * ```js\n * const a =\n *   tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n * a.lessEqual(b).print();\n * ```\n *\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\n * @function lessEqual_<T extends Tensor>(\n *   a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n *     let $a = convertToTensor(a, 'a', 'lessEqual');\n *     let $b = convertToTensor(b, 'b', 'lessEqual');\n *     [$a, $b] = makeTypesMatch($a, $b);\n *     assertAndGetBroadcastShape($a.shape, $b.shape);\n *     const inputs: LessEqualInputs = {a: $a, b: $b};\n *     return ENGINE.runKernel(LessEqual, inputs as { } as NamedTensorMap);\n *   }\n */\n\nexport const lessEqual =\n * op({lessEqual_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {LinSpace, LinSpaceAttrs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D} from './tensor';\n\n/**\n * Return an evenly spaced sequence of numbers over the given interval.\n *\n * ```js\n * tf.linspace(0, 9, 10).print();\n * ```\n *\n * @param start The start value of the sequence.\n * @param stop The end value of the sequence.\n * @param num The number of values to generate.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\n * @function linspace(start: number, stop: number, num: number): Tensor1D {\n *   if (num <= 0) {\n *     throw new Error("The number of values should be positive.");\n *   }\n *   const attrs: LinSpaceAttrs = {start, stop, num};\n *   return ENGINE.runKernel(LinSpace, {}, attrs as { } as NamedAttrMap);\n * }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {LRN, LRNAttrs, LRNInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Normalizes the activation of a local neighborhood across or within\n * channels.\n *\n * @param x The input tensor. The 4-D input tensor is treated as a 3-D array\n *   of 1D vectors (along the last dimension), and each vector is\n *   normalized independently.\n * @param depthRadius The number of adjacent channels in the 1D normalization\n *   window.\n * @param bias A constant bias term for the basis.\n * @param alpha A scale factor, usually positive.\n * @param beta An exponent.\n *\n * @doc {heading: 'Operations', subheading:
```

```

'Normalization')\n */\nfunction localResponseNormalization_<T extends Tensor3D|Tensor4D>(n x:
T|TensorLike, depthRadius = 5, bias = 1, alpha = 1, beta = 0.5): T {\n const $x = convertToTensor(x, 'x',
'localResponseNormalization');\n util.assert(\n $x.rank === 4 || $x.rank === 3,\n () => `Error in
localResponseNormalization: x must be rank 3 or 4 but got\n rank ${$x.rank}.`);\n util.assert(\n
util.isInt(depthRadius),\n () => `Error in localResponseNormalization: depthRadius must be an `+\n
`integer but got depthRadius ${depthRadius}.`);\n let x4D = $x as Tensor4D;\n let reshapedTo4D = false;\n if
($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n
}\n\n const inputs: LRNInputs = {x: x4D};\n\n const attrs: LRNAttrs = {depthRadius, bias, alpha, beta};\n\n //
tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n
LRN, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n\n if (reshapedTo4D)
{\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n } else {\n return res;\n }\n}\n\nexport
const localResponseNormalization = op({localResponseNormalization_});\n"/**\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ENGINE} from './engine';\nimport {Log, LogInputs} from './kernel_names';\nimport {Tensor} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes
natural logarithm of the input `tf.Tensor` element-wise: `ln(x)`\n * \n * \n * const x = tf.tensor1d([1, 2,
Math.E]);\n * \n * x.log().print(); // or tf.log(x)\n * \n * @param x The input tensor.\n * \n * @doc {heading:
'Operations', subheading: 'Basic math'}\n */\nfunction log_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'log');\n\n const inputs: LogInputs = {x: $x};\n return ENGINE.runKernel(Log, inputs as {}
as NamedTensorMap);\n}\n\nexport const log = op({log_});\n"/**\n * @license\n * Copyright 2018 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ENGINE} from './engine';\nimport {Log1p, Log1pInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
natural logarithm of the input `tf.Tensor` plus one\n * element-wise: `ln(1 + x)`\n * \n * \n * const x =
tf.tensor1d([1, 2, Math.E - 1]);\n * \n * x.log1p().print(); // or tf.log1p(x)\n * \n * @param x
The input tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction log1p_<T extends
Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'log1p');\n\n const inputs: Log1pInputs = {x:
$x};\n return ENGINE.runKernel(Log1p, inputs as {} as NamedTensorMap);\n}\n\nexport const log1p =
op({log1p_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See

```

the License for the specific language governing permissions and limitations under the License.

```
=====
import { CustomGradientFunc, ENGINE } from './engine'; import { Scalar, Tensor, Variable } from
 './tensor'; import { NamedTensorMap } from './tensor_types'; import { convertToTensor, convertToTensorArray }
 from './tensor_util_env'; import { TensorLike } from './types'; import * as util from './util';
function f(x: TensorLike): Tensor {
  // f(x) = x^2
  const f = x => x.square();
  // f'(x) = 2x
  const g = tf.grad(f);
  const x = tf.tensor1d([2, 3]);
  g(x).print();
  // f(x) = x^3
  const f = x => x.pow(tf.scalar(3, 'int32'));
  // f'(x) = 3x^2
  const g = tf.grad(f);
  // f''(x) = 6x
  const gg = tf.grad(g);
  const x = tf.tensor1d([2, 3]);
  gg(x).print();
  @param f The function f(x), to compute gradient for.
  @doc {heading: 'Training', subheading: 'Gradients'}
  function grad(f: (x: Tensor) => Tensor): (x: TensorLike | Tensor, dy?: TensorLike | Tensor) => Tensor {
    util.assert(util.isFunction(f), () => 'The f passed in grad(f) must be a function');
    return (x: TensorLike | Tensor, dy?: TensorLike | Tensor): Tensor => {
      // x can be of any dtype, thus null as the last argument.
      const $x = convertToTensor(x, 'x', 'tf.grad', 'string_or_numeric');
      const $dy: Tensor = (dy != null) ? convertToTensor(dy, 'dy', 'tf.grad') : null;
      return ENGINE.tidy(() => {
        const { value, grads } = ENGINE.gradients(() => f($x), [$x], $dy);
        if ($dy != null) {
          util.assertShapesMatch(value.shape, $dy.shape, 'The shape of dy passed in grad(f)(x, dy) must match the shape ' + value.shape + ' returned by f(x)');
          checkGrads(grads);
          return grads[0];
        }
        // Provided f(x1, x2, ...), returns another function g(x1, x2, ..., dy) which gives an array of gradients of f with respect to each input [x1, x2, ...]. If dy is passed when calling g(), the gradient of f(x1, ...).mul(dy).sum() with respect to each input is computed instead. The provided f must take one or more tensors and return a single tensor y. If f() takes a single input, we recommend using tf.grad instead.
        // f(a, b) = a * b
        const f = (a, b) => a.mul(b);
        // df / da = b, df / db = a
        const g = tf.grad(f);
        const a = tf.tensor1d([2, 3]);
        const b = tf.tensor1d([-2, -3]);
        const [da, db] = g([a, b]);
        console.log('da');
        da.print();
        console.log('db');
        db.print();
        @param f The function f(x1, x2, ...) to compute gradients for.
        @doc {heading: 'Training', subheading: 'Gradients'}
        function grads(f: (...args: Tensor[]) => Tensor): (args: Array<Tensor | TensorLike>, dy?: Tensor | TensorLike) => Tensor[] {
          util.assert(util.isFunction(f), () => 'The f passed in grads(f) must be a function');
          return (args: Array<Tensor | TensorLike>, dy?: Tensor | TensorLike): Tensor[] => {
            util.assert(Array.isArray(args), () => 'The args passed in grads(f)(args) must be an array ' + args + ' of Tensor's or TensorLike's');
            // args can be of any dtype, thus null as the last argument.
            const $args = convertToTensorArray(args, 'args', 'tf.grads', 'string_or_numeric');
            const $dy: Tensor = (dy != null) ? convertToTensor(dy, 'dy', 'tf.grads') : null;
            return ENGINE.tidy(() => {
              const { value, grads } = ENGINE.gradients(() => f(...$args), $args, $dy);
              if ($dy != null) {
                util.assertShapesMatch(value.shape, $dy.shape, 'The shape of dy passed in grads(f)([x1, ...], dy) must ' + value.shape + ' match the shape returned by f([x1, ...])');
                checkGrads(grads);
                return grads;
              }
            });
          }
        }
        // Like tf.grad, but also returns the value of f(). Useful when f() returns a metric you want to show.
        // The result is a rich object with the following properties:
        // - grad: The gradient of f(x) w.r.t x (result of tf.grad).
        // - value: The value returned by f(x).
        // f(x) = x^2
        const f = x => x.square();
        // f'(x) = 2x
        const g = tf.valueAndGrad(f);
        const x = tf.tensor1d([2, 3]);
        const { value, grad } = g(x);
        console.log('value');
        value.print();
        console.log('grad');
        grad.print();
        @doc {heading: 'Training', subheading: 'Gradients'}
        function valueAndGrad<I extends Tensor, O extends Tensor>(f: (x: I) => O): (x: I, dy?: O) => {
          value: O;
          grad: I;
        }
        util.assert(util.isFunction(f), () => 'The f passed in valueAndGrad(f)

```



```

must return a scalar, but it `+` returned a rank- $\{value.rank\}$  tensor`);
const namedGrads:
NamedTensorMap = {};
varList.forEach((v, i) => {
  if (gradients[i] != null) {
    namedGrads[v.name] =
gradients[i];
  }
  if (specifiedNonTrainable != null) {
    // If varList is explicitly provided and contains non-
trainable values,
    // add them to the returned gradients with `null` values.
    specifiedNonTrainable.forEach(v
=> namedGrads[v.name] = null);
  }
  return {value, grads:
namedGrads};
});
// Overrides the gradient computation of a function `f`.
// Takes a function `f`
// and returns another function `g`
// which takes the same inputs as `f`.
// When called, `g` returns `f().value`.
// In backward mode, custom
gradients with respect to each input of `f`
are computed using `f().gradFunc`.
// The `save` function passed
to `f` should be used for saving tensors needed
in the gradient.
// And the `saved` passed to the `gradFunc`
is a `NamedTensorMap`, which contains those saved tensor.
const customOp = tf.customGrad((x, save)
=> {
  // Save x to make sure it's available later
for the gradient.
  save([x]);
  // Override gradient of our
custom x^2 op to be dy * abs(x).
  return {
    value: x.square(),
    // Note `saved.x` which points to the
`x` we saved earlier.
    gradFunc: (dy, saved) => [dy.mul(saved[0].abs())]
  };
});
const x = tf.tensor1d([-1, -2, 3]);
const dx = tf.grad(x => customOp(x));
console.log(`f(x):`);
customOp(x).print();
console.log(`f'(x):`);
dx(x).print();
// @param f
The function to evaluate in forward mode, which should return
{value: Tensor, gradFunc: (dy, saved) =>
Tensor[]},
where `gradFunc` returns the custom gradients of `f`
with respect to its inputs.
// @doc
{heading: 'Training', subheading: 'Gradients'}
function customGrad<T extends Tensor>(f:
CustomGradientFunc<T>):
(...args: Tensor[]) => T {
  return ENGINE.customGrad(f);
}
function
checkGrads(grads: Tensor[]) {
  const numNullGradients = grads.filter(g => g == null).length;
  if
(numNullGradients > 0) {
    throw new Error(`Cannot compute gradient of y=f(x)
with respect to x. Make
sure that the f you passed encloses all operations
that lead from x to y.`);
  }
}
export {
  customGrad,
  variableGrads,
  valueAndGrad,
  valueAndGrads,
  grad,
  grads,
};
"/**
 * @license
 * Copyright 2018
Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0
(the "License");
 * you may not use this file except in compliance
with the License.
 * You may obtain a copy of the License at
 *
 * http://www.apache.org/licenses/LICENSE-2.0
 *
 * Unless required by applicable law or agreed to
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software
 * distributed under the License is distributed on
an "AS IS" BASIS,
 * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND,
either express or implied.
 * See the License for the specific language
governing permissions and
 * limitations under the License.
 */
=====
import {ENGINE} from '../engine';
import {Neg, NegInputs} from '../kernel_names';
import {Tensor} from
 '../tensor';
import {NamedTensorMap} from
 '../tensor_types';
import {convertToTensor}
from
 '../tensor_util_env';
import {TensorLike} from
 '../types';
import {op} from
 '../operation';
// Computes `x` element-wise.
const x = tf.tensor2d([1, 2, -2, 0], [2, 2]);
x.neg().print();
// or tf.neg(x)
// @param x
The input tensor.
// @doc
{heading: 'Operations', subheading: 'Basic
math'}
function neg_<T extends Tensor>(x: T|TensorLike):
T {
  const $x = convertToTensor(x, 'x',
'neg');
  const inputs: NegInputs = {x: $x};
  return ENGINE.runKernel(Neg, inputs as {} as
NamedTensorMap);
}
export const neg = op({neg_});
"/**
 * @license
 * Copyright 2018 Google LLC. All
Rights Reserved.
 * Licensed under the Apache License, Version 2.0
(the "License");
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 * limitations under the License.
 */
=====
import {ENGINE} from '../engine';
import {Softplus, SoftplusInputs} from
 '../kernel_names';

```



```

max_<T extends Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n  const
$x = convertToTensor(x, 'x', 'max');\n  const inputs: MaxInputs = {x: $x};\n  const attrs: MaxAttrs =
{reductionIndices: axis, keepDims};\n\n  return ENGINE.runKernel(\n    Max, inputs as {} as NamedTensorMap,
attrs as {} as NamedAttrMap);\n\n\nexport const max = op({max_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {ENGINE} from './engine';\nimport {Sub, SubInputs} from './kernel_names';\nimport {Tensor} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
 './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 {op} from './operation';\n\n/*\n * Subtracts two `tf.Tensor`s element-wise, A - B. Supports broadcasting.\n
*\n * ``js\n * const a = tf.tensor1d([10, 20, 30, 40]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n *\n * a.sub(b).print();
// or tf.sub(a, b)\n * ``\n *\n * ``js\n * // Broadcast subtract a with b.\n * const a = tf.tensor1d([10, 20, 30, 40]);\n *
const b = tf.scalar(5);\n *\n * a.sub(b).print(); // or tf.sub(a, b)\n * ``\n * @param a The first `tf.Tensor` to subtract
from.\n * @param b The second `tf.Tensor` to be subtracted. Must have the same dtype as\n * `a`.\n *\n * @doc
{heading: 'Operations', subheading: 'Arithmetic'}\n\nfunction sub_<T extends Tensor>(a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'sub');\n  let $b = convertToTensor(b, 'b', 'sub');\n  [$a,
$b] = makeTypesMatch($a, $b);\n\n  const inputs: SubInputs = {a: $a, b: $b};\n\n  return ENGINE.runKernel(Sub,
inputs as {} as NamedTensorMap);\n\n\nexport const sub = op({sub_});\n", "/*\n * @license\n * Copyright 2018
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the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\nimport {ENGINE} from './engine';\nimport {Sum, SumAttrs, SumInputs} from './kernel_names';\nimport
 {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\nimport {cast} from './cast';\nimport {op} from
 './operation';\n\n/*\n * Computes the sum of elements across dimensions of a `tf.Tensor`.\n *\n * Reduces the input
along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the `tf.Tensor` is reduced by 1 for
each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are retained with\n * length 1. If axes has no
entries, all dimensions are reduced, and a\n * `tf.Tensor` with a single element is returned.\n *\n * ``js\n * const x =
tf.tensor1d([1, 2, 3]);\n *\n * x.sum().print(); // or tf.sum(x)\n * ``\n *\n * ``js\n * const x = tf.tensor2d([1, 2, 3, 4],
[2, 2]);\n *\n * const axis = 1;\n *\n * x.sum(axis).print(); // or tf.sum(x, axis)\n * ``\n *\n * @param x The input tensor
to compute the sum over. If the dtype is `bool`\n * it will be converted to `int32` and the output dtype will be
`int32`.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param
keepDims If true, retains reduced dimensions
with size 1.\n *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n\nfunction sum_<T extends
Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n  let $x =
convertToTensor(x, 'x', 'sum');\n  if ($x.dtype === 'bool') {\n    $x = cast($x, 'int32');\n  }\n\n  const inputs:
SumInputs = {x: $x};\n  const attrs: SumAttrs = {axis, keepDims};\n\n  return ENGINE.runKernel(\n    Sum,

```


inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
n\n\nexport const sum = op({sum_});
n", "/*
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n * limitations under the License.
n *

```
=====
*\n\nimport {customGrad} from './gradients';
\nimport {Tensor} from './tensor';
\nimport {GradSaveFunc} from
'./tensor_types';
\nimport {convertToTensor} from './tensor_util_env';
\nimport {TensorLike} from
'./types';
\nimport {cast} from './cast';
\nimport {exp} from './exp';
\nimport {log} from './log';
\nimport {max} from
'./max';
\nimport {mul} from './mul';
\nimport {op} from './operation';
\nimport {sub} from './sub';
\nimport {sum}
from './sum';
\n\n/*
n * Computes the log softmax.
n *
n * ``js
n * const a = tf.tensor1d([1, 2, 3]);
n *
n * a.logSoftmax().print(); // or tf.logSoftmax(a)
n *
n * ``\n *
n * ``js
n * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);
n *
n * a.logSoftmax().print(); // or tf.logSoftmax(a)
n *
n *
n * @param logits The logits array.
n * @param axis The dimension softmax would be performed on. Defaults to -1
n * which indicates the last dimension.
n *
n * @doc {heading: 'Operations', subheading: 'Normalization'}
\n\nfunction logSoftmax<T extends Tensor>(logits: T|TensorLike, axis = -1): T {
\n  const $logits =
convertToTensor(logits, 'logits', 'logSoftmax');
\n\n  if (axis === -1) {
\n    axis = $logits.rank - 1;
\n  }
\n  if (axis !==
$logits.rank - 1) {
\n    throw Error(`Log Softmax along a non-last dimension is not yet supported. `
+
`Logits was rank ${$logits.rank} and axis was ${axis}`);
\n  }
\n\n  // const forward: ForwardFunc<Tensor> =
(backend, save) => {
\n    // const keepDims = true;
\n    // const xMax = max(logits, axis, true);
\n    // const shifted =
sub(logits, xMax);
\n    // const value =
\n    // sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis,
\n    //
keepDims)));
\n    // save([value]);
\n    // return value;
\n  };
\n\n  // Use a
custom gradient for numerical stability.
\n  const customOp = customGrad((logits: Tensor, save: GradSaveFunc) =>
{
\n    const keepDims = true;
\n    const xMax = max(logits, axis, true);
\n    const shifted = sub(logits, xMax);
\n    const value =
\n    sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis, keepDims)));
\n    save([value]);
\n\n    const gradFunc = (dy: Tensor, saved: Tensor[]) => {
\n      const [value] = saved;
\n      const keepDims = true;
\n      const softmax = exp(value);
\n      return sub(dy, mul(sum(dy, axis, keepDims), softmax));
\n    };
\n    return {value,
gradFunc};
\n  });
\n\n  return customOp($logits) as T;
\n\n  // TODO Use Engine.runKernel when
CPU/WebGL/WASM backends implement this.
\n  // const inputs: LogSoftmaxInputs = {logits: $logits};
\n  // const
attrs: LogSoftmaxAttrs = {axis};
\n  // return ENGINE.runKernel(
\n  // LogSoftmax, inputs as {} as
NamedTensorMap,
\n  // attrs as {} as NamedAttrMap);
\n\n\nexport const logSoftmax =
op({logSoftmax_});
n", "/*
```

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n *

```
=====
*\n\nimport * as util from './util';
\n\n/*
n * Returns true if the axis specifies the inner most dimensions of the
n * array.
\n\nexport function axesAreInnerMostDims(axes: number[], rank: number): boolean {
\n  for (let i = 0; i <
axes.length; ++i) {
\n    if
(axes[axes.length - i - 1] !== rank - 1 - i) {
\n      return false;
\n    }
\n  }
\n  return true;
\n}\n\nexport function
combineLocations(
\n  outputLoc: number[], reduceLoc: number[], axes: number[]): number[] {
\n  const rank =
outputLoc.length + reduceLoc.length;
\n  const loc = [];
\n  let outIdx = 0;
\n  let reduceIdx = 0;
\n  for (let dim = 0;
```

```

dim < rank; dim++) {\n  if (axes.indexOf(dim) === -1) {\n    loc.push(outputLoc[outIdx++]);\n  } else {\n    loc.push(reduceLoc[reduceIdx++]);\n  }\n}\n return loc;\n}\n\nexport function computeOutAndReduceShapes(\n  aShape: number[], axes: number[]): [number[], number[]] {\n  const outShape = [];\n  const rank =\n  aShape.length;\n  for (let dim = 0; dim < rank; dim++) {\n    if (axes.indexOf(dim) === -1) {\n      outShape.push(aShape[dim]);\n    }\n  }\n  const reduceShape = axes.map(dim => aShape[dim]);\n  return\n  [outShape, reduceShape];\n}\n\nexport function expandShapeToKeepDim(\n  shape: number[], axes: number[]):\n  number[]\n  {\n    const reduceSubShape = axes.map(x => 1);\n    return combineLocations(shape, reduceSubShape,\n    axes);\n  }\n\nexport function assertAxesAreInnerMostDims(\n  msg: string, axes: number[], rank: number): void\n  {\n    util.assert(\n      axesAreInnerMostDims(axes, rank),\n      () => `${msg} supports only inner-most axes for now.\n    `);\n    `Got axes ${axes} and rank-${rank} input.`);\n  }\n\n  /**\n   * Returns the axes permutation to be used with\n   * `tf.transpose`, if such\n   * permutation is necessary. Otherwise it returns null. This method is used by\n   * operations\n   * that operate only on inner-most axes.\n   */\n  export function getAxesPermutation(axes: number[], rank: number):\n    number[]\n    null {\n      if (axesAreInnerMostDims(axes, rank)) {\n        return null;\n      }\n      const result: number[] = [];\n      for (let i = 0; i < rank; ++i) {\n        if (axes.indexOf(i) === -1) {\n          result.push(i);\n        }\n      }\n      axes.forEach(axis =>\n      result.push(axis));\n      return result;\n    }\n\n    /**\n     * Returns the axes permutation\n     * that undoes the original permutation.\n     */\n    export function getUndoAxesPermutation(axes: number[]): number[] {\n      return axes.map((axis, i) => [i, axis])\n      .sort((a, b) => a[1] - b[1])\n      .map(x => x[0]);\n    }\n\n    export function\n    getInnerMostAxes(numAxes: number, rank: number): number[] {\n      const res: number[] = [];\n      for (let i = rank -\n      numAxes; i < rank; ++i) {\n        res.push(i);\n      }\n      return res;\n    }\n  }\n\n  /**\n   * @license\n   * Copyright 2020 Google\n   * LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not\n   * use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * \n   * http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing,\n   * software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES\n   * OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language\n   * governing\n   * permissions and\n   * limitations under the License.\n   */\n\n  =====\n\n  /**\n   * @nimport {Tensor} from './tensor';\n   * @nimport {convertToTensor} from './tensor_util_env';\n   * @nimport {TensorLike}\n   * from './types';\n   * @nimport {parseAxisParam} from './util';\n   * @nimport {add} from './add';\n   * @nimport\n   * {expandShapeToKeepDim} from './axis_util';\n   * @nimport {exp} from './exp';\n   * @nimport {log} from './log';\n   * @nimport {max}\n   * from './max';\n   * @nimport {op} from './operation';\n   * @nimport {reshape} from './reshape';\n   * @nimport {sub} from\n   * './sub';\n   * @nimport {sum} from './sum';\n   */\n\n  /**\n   * Computes the log(sum(exp(elements across the reduction\n   * dimensions)).\n   * \n   * Reduces the input along the dimensions given in `axis`. Unless `keepDims`\n   * is true, the\n   * rank of the array is reduced by 1 for each entry in `axis`. \n   * \n   * If `keepDims` is true, the reduced dimensions are\n   * retained with length 1.\n   * \n   * If `axis` has no entries, all dimensions are reduced, and an array with a\n   * single\n   * element is returned.\n   */\n  /**\n   * @js\n   * const x = tf.tensor1d([1, 2, 3]);\n   * \n   * x.logSumExp().print(); // or\n   * tf.logSumExp(x)\n   * \n   * \n   * \n   * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n   * \n   * const axis = 1;\n   * \n   * x.logSumExp(axis).print(); // or tf.logSumExp(a, axis)\n   */\n  /**\n   * @param x The input tensor.\n   * @param axis The\n   * dimension(s) to reduce. If null (the default),\n   * reduces all dimensions.\n   * @param keepDims If true, retains\n   * reduced dimensions with length\n   * of 1. Defaults to false.\n   */\n  /**\n   * @doc {heading: 'Operations', subheading:\n   * 'Reduction'}\n   */\n  export function logSumExp<T extends Tensor>(\n    x: Tensor|TensorLike, axis: number|number[] =\n    null, keepDims = false): T {\n    const $x = convertToTensor(x, 'x', 'logSumExp');\n    const axes =\n    parseAxisParam(axis, $x.shape);\n    const xMax = max($x, axes, true /* keepDims */);\n    const a = sub($x, xMax);\n    const b = exp(a);\n    const c = sum(b, axes);\n    const d = log(c);\n    const res = add(reshape(xMax, d.shape),\n    d);\n    if (keepDims) {\n      const newShape = expandShapeToKeepDim(res.shape, axes);\n      return reshape(res,\n      newShape) as T;\n    }\n    return res as T;\n  }\n\n  export const logSumExp = op({logSumExp});\n\n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version

```

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```
=====  
*\\nimport {ENGINE} from './engine';\\nimport {LogicalAnd, LogicalAndInputs}  
from './kernel_names';\\nimport {Tensor} from './tensor';\\nimport {NamedTensorMap} from  
 './tensor_types';\\nimport {convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from  
 './types';\\n\\nimport {assertAndGetBroadcastShape} from './broadcast_util';\\nimport {op} from './operation';\\n\\n**\\n  
 * Returns the truth value of `a AND b` element-wise. Supports broadcasting.\\n * ``js\\n * const a =  
 tf.tensor1d([false, false, true, true], 'bool');\\n * const b = tf.tensor1d([false, true, false, true], 'bool');\\n *  
 a.logicalAnd(b).print();\\n * ``\\n * @param a The first input tensor. Must be of dtype bool.\\n * @param b The  
 second input tensor. Must be of dtype bool.\\n * @doc {heading: 'Operations', subheading: 'Logical'}\\n  
 *\\nfunction logicalAnd_<T extends Tensor>(\\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\\n  const $a =  
 convertToTensor(a, 'a', 'logicalAnd', 'bool');\\n  const $b = convertToTensor(b, 'b', 'logicalAnd', 'bool');\\n  
  assertAndGetBroadcastShape($a.shape,  
    $b.shape);\\n  \\n  const inputs: LogicalAndInputs = {a: $a, b: $b};\\n  \\n  return ENGINE.runKernel(LogicalAnd, inputs  
 as { } as NamedTensorMap);\\n}\\n\\nexport const logicalAnd = op({logicalAnd_});\\n", "**\\n * @license\\n *  
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 the specific language governing permissions and\\n * limitations under the License.\\n *  
=====  
*\\nimport {ENGINE} from './engine';\\nimport {LogicalNot, LogicalNotInputs}  
from './kernel_names';\\nimport {Tensor} from './tensor';\\nimport {NamedTensorMap} from  
 './tensor_types';\\nimport {convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from './types';\\nimport  
 {op} from './operation';\\n\\n**\\n * Returns the truth value of `NOT x` element-wise.\\n * ``js\\n * const a =  
 tf.tensor1d([false, true], 'bool');\\n * a.logicalNot().print();\\n * ``\\n * @param x The input tensor. Must be of  
 dtype 'bool'.\\n * @doc {heading: 'Operations', subheading: 'Logical'}\\n *\\nfunction logicalNot_<T extends  
 Tensor>(x: T|TensorLike): T {\\n  const $x = convertToTensor(x, 'x', 'logicalNot', 'bool');\\n  const inputs:  
 LogicalNotInputs = {x: $x};\\n  return ENGINE.runKernel(LogicalNot, inputs as { } as  
 NamedTensorMap);\\n}\\n\\nexport const logicalNot = op({logicalNot_});\\n", "**\\n * @license\\n * Copyright 2020  
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 OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language  
 governing permissions and\\n * limitations under the License.\\n *  
=====  
*\\nimport {ENGINE} from './engine';\\nimport {LogicalOr, LogicalOrInputs} from './kernel_names';\\nimport  
 {Tensor} from './tensor';\\nimport {NamedTensorMap} from './tensor_types';\\nimport {convertToTensor} from  
 './tensor_util_env';\\nimport {TensorLike} from './types';\\nimport {assertAndGetBroadcastShape} from  
 './broadcast_util';\\nimport {op} from './operation';\\n\\n**\\n * Returns the truth value of `a OR b` element-wise.  
 Supports broadcasting.\\n
```

```

*\n * ``js\n * const a = tf.tensor1d([false, false, true, true], 'bool');\n * const b = tf.tensor1d([false, true, false, true],
'bool');\n * a.logicalOr(b).print();\n * ``\n * @param a The first input tensor. Must be of dtype bool.\n *
@param b The second input tensor. Must be of dtype bool.\n * @doc {heading: 'Operations', subheading:
'Logical'}\n */\nfunction logicalOr_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n
const $a = convertToTensor(a, 'a', 'logicalOr', 'bool');\n const $b = convertToTensor(b, 'b', 'logicalOr', 'bool');\n
assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: LogicalOrInputs = {a: $a, b: $b};\n return
ENGINE.runKernel(LogicalOr, inputs as { } as NamedTensorMap);\n}\n\nexport const logicalOr =
op({logicalOr_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
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```

```

=====\n
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {logicalAnd} from
'/logical_and';\nimport {logicalNot} from './logical_not';\nimport {logicalOr} from './logical_or';\nimport {op} from
'/operation';\n\n/**\n * Returns the truth value of `a XOR b` element-wise. Supports broadcasting.\n *
*\n * ``js\n * const a = tf.tensor1d([false,
false, true, true], 'bool');\n * const b = tf.tensor1d([false, true, false, true], 'bool');\n * a.logicalXor(b).print();\n *
``\n * @param a The first input tensor. Must be of dtype bool.\n * @param b The second input tensor. Must be
of dtype bool.\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction logicalXor_<T extends
Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n const $a = convertToTensor(a, 'a', 'logicalXor',
'bool');\n const $b = convertToTensor(b, 'b', 'logicalXor', 'bool');\n assertAndGetBroadcastShape($a.shape,
$b.shape);\n\n // x ^ y = (x | y) & ~(x & y)\n return logicalAnd(logicalOr(a, b), logicalNot(logicalAnd(a,
b)));}\n\nexport const logicalXor = op({logicalXor_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {MaxPool, MaxPoolAttrs, MaxPoolInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport * as conv_util
from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the
2D max pooling of an image.\n *
*\n * @param x The input tensor, of rank 4 or rank 3 of shape\n *   `[batch, height,
width, inChannels]`. If rank 3, batch of 1 is assumed.\n * @param filterSize The filter size: `[filterHeight,
filterWidth]`. If\n *   `filterSize` is a single number, then `filterHeight == filterWidth`.\n * @param strides The
strides of the pooling: `[strideHeight, strideWidth]`. If\n *   `strides` is a single number, then `strideHeight ==
strideWidth`.\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]` in which we sample
input values across the height and width dimensions\n *   in dilated pooling. Defaults to `[1, 1]`. If `dilations` is a
single\n *   number, then `dilationHeight == dilationWidth`. If it is greater than\n *   1, then all values of `strides`
must be 1.\n * @param pad The type of padding algorithm.\n *   - `same` and stride 1: output will be of same size
as input,\n *   regardless of filter size.\n *   - `valid`:\n *

```

```

output will be smaller than input if filter is larger than 1x1. - For more info, see this guide:
[https://www.tensorflow.org/api_guides/python/nn#Convolution]
https://www.tensorflow.org/api_guides/python/nn#Convolution) @param dimRoundingMode A string from:
'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
function maxPool_<T extends Tensor3D|Tensor4D>(x: T|TensorLike, filterSize: [number, number]|number,
strides: [number, number]|number, pad: 'valid'|'same'|number, dimRoundingMode?: 'floor'|'round'|'ceil'): T {
const $x = convertToTensor(x, 'x', 'maxPool');
const dilations = 1;
let x4D = $x as Tensor4D;
let reshapedTo4D = false;
if ($x.rank === 3) {
reshapedTo4D = true;
x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
}
util.assert(x4D.rank === 4, () => `Error in maxPool: input must be rank 4 but got rank ${x4D.rank}`);
util.assert(conv_util.eitherStridesOrDilationsAreOne(strides, dilations), () => `Error in maxPool: Either
strides or dilations must be 1.` + `Got strides ${strides} and dilations ${dilations}`);
if (dimRoundingMode != null) {
util.assert(util.isInt(pad as number), () => `Error in maxPool: pad
must be an integer when using, ` + `dimRoundingMode ${dimRoundingMode} but got pad ${pad}`);
}
const inputs: MaxPoolInputs = {x: x4D};
const attrs: MaxPoolAttrs = {filterSize, strides, pad, dimRoundingMode};
// tslint:disable-next-line: no-unnecessary-type-assertion
const res = ENGINE.runKernel(MaxPool, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap) as T;
if (reshapedTo4D) {
return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
T;
}
return res;
}
export const maxPool = op({maxPool_});
/**
 * Copyright
 * 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing,
 * software distributed under the License is distributed on an "AS IS"
 * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
 * or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 */
}

import {ENGINE} from '../engine';
import {MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs} from
'./kernel_names';
import {NamedAttrMap} from './kernel_registry';
import {Tensor4D, Tensor5D} from
'./tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from
'./tensor_util_env';
import {TensorLike} from './types';
import * as util from './util';
import {op} from './operation';
import {reshape} from './reshape';
/**
 * Computes the 3D max pooling.
 */
const x = tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]);
const result = tf.maxPool3d(x, 2, 1, 'valid');
result.print();
@param x The input tensor, of rank 5 or rank 4 of shape
[batch, depth, height, width, inChannels].
@param filterSize The filter size:
[filterDepth, filterHeight, filterWidth].
If filterSize is a single number, then
filterDepth == filterHeight == filterWidth.
@param strides The strides of the pooling:
[strideDepth, strideHeight, strideWidth].
If strides is a single number, then
strideDepth == strideHeight ==
strideWidth.
@param pad The type of padding algorithm.
- `same` and stride 1: output will be of same
size as input, regardless of
filter size.
- `valid`: output will be smaller than input if filter is larger
than 1*1x1. - For more
info, see this guide:
[https://www.tensorflow.org/api_guides/python/nn#Convolution]
https://www.tensorflow.org/api_guides/python/nn#Convolution) @param dimRoundingMode A string from:
'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
@param dataFormat An optional string
from: "NDHWC", "NCDHW". Defaults to
"NDHWC". Specify the data format of the input and output
data. With the default format "NDHWC", the data is stored in the order of:
[batch, depth, height, width, channels]. Only "NDHWC" is currently supported.
@doc {heading: 'Operations', subheading:
'Convolution'}
function maxPool3d_<T extends Tensor4D|Tensor5D>(x: T|TensorLike, filterSize:
[number, number, number]|number = [1, 1, 1],
strides: [number, number, number]|number, pad:

```

```

'valid'|'same'|number,\n
    dimRoundingMode?: 'floor'|'round'|'ceil',\n    dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {\n    const $x =
convertToTensor(x, 'x', 'maxPool3d');\n\n    let x5D = $x as Tensor5D;\n    let reshapedTo5D = false;\n    if ($x.rank
=== 4) {\n        reshapedTo5D = true;\n        x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2],
$x.shape[3]]);\n    }\n\n    util.assert(\n        x5D.rank === 5,\n        () => `Error in maxPool3d: x must be rank 5 but got
rank ${x5D.rank}.`);\n    util.assert(\n        dataFormat === 'NDHWC',\n        () => `Error in maxPool3d: Only NDHWC
is currently supported, ` +\n        `but got dataFormat of ${dataFormat}`);\n    if (dimRoundingMode != null) {\n
util.assert(\n        util.isInt(pad as number),\n        () => `Error in maxPool3d: pad must be an integer when using, `
+\n        `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n    }\n\n    const inputs:
MaxPool3DInputs = {x: x5D};\n\n    const attrs:\n        MaxPool3DAttrs = {filterSize, strides, pad,
dimRoundingMode, dataFormat};\n\n    // tslint:disable-next-line: no-unnecessary-type-assertion\n    const res =
ENGINE.runKernel(\n        MaxPool3D, inputs as {} as NamedTensorMap,\n        attrs as {} as
NamedAttrMap) as T;\n\n    if (reshapedTo5D) {\n        return reshape(\n            res, [res.shape[1], res.shape[2],
res.shape[3], res.shape[4]]) as\n            T;\n    }\n\n    return res;\n}\n\nexport const maxPool3d =
op({maxPool3d_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ENGINE} from './engine';\nimport {MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs,
MaxPoolWithArgmaxInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from
'/operation';\n\n/**\n * Computes the 2D max pooling of an image with Argmax index.\n * The indices in argmax
are flattened, so that a maximum value at position `[b, y, x, c]` becomes flattened index: `(y * width + x) *
channels + c` if\n * `include_batch_in_index` is False; `((b * height + y) * width + x) * channels + c` if
`include_batch_in_index` is True.\n * The indices returned are always in `[0, height) x [0,
width)` before\n * flattening.\n * @param x The input tensor, of rank 4 or rank 3 of shape `[batch, height,
width, inChannels]`. If rank 3, batch of 1 is assumed.\n * @param filterSize The filter size: `[filterHeight,
filterWidth]`. If\n * `filterSize` is a single number, then `filterHeight == filterWidth`.\n * @param strides The
strides of the pooling: `[strideHeight, strideWidth]`. If\n * `strides` is a single number, then `strideHeight ==
strideWidth`.\n * @param dataFormat An optional string from: `"NDHWC"`, `"NCDHW"`. Defaults to\n *
`"NDHWC"`. Specify the data format of the input and output data. With the\n * default format `"NDHWC"`, the
data is stored in the order of: [batch,\n * depth, height, width, channels]. Only `"NDHWC"` is currently
supported.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size
as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than
input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n *
[https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param includeBatchIndex Defaults to False.
Whether to include batch\n * dimension in flattened index of argmax.\n * @doc {heading: 'Operations',
subheading: 'Convolution'}\n */\nfunction maxPoolWithArgmax_<T extends Tensor4D>(\n    x: T|TensorLike,\n    filterSize: [number, number]|number,\n    strides: [number, number]|number, pad: 'valid'|'same'|number,\n    includeBatchInIndex = false): NamedTensorMap {\n    const $x = convertToTensor(x, 'x',
'maxPoolWithArgmax');\n\n    const inputs: MaxPoolWithArgmaxInputs = {x: $x};\n    const attrs:\n        MaxPoolWithArgmaxAttrs = {filterSize, strides, pad, includeBatchInIndex};\n\n    // tslint:disable-next-line: no-

```

unnecessary-type-assertion\n const result = ENGINE.runKernel(\n MaxPoolWithArgmax,
inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor[];\n\n return {result:
result[0], indexes: result[1]};\n}\n\nexport const maxPoolWithArgmax = op({maxPoolWithArgmax_});\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====

*\n\nimport {ENGINE} from './engine';\nimport {Maximum, MaximumInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Returns the max of a and b (a > b ? a : b) element-wise.\n * Supports broadcasting.\n * We also expose `tf.maximumStrict` which has the same signature as this op and asserts that `a` and `b` are the same shape (does not broadcast).\n * `js`\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n * a.maximum(b).print(); // or tf.maximum(a, b)\n * Broadcast maximum a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n * a.maximum(b).print(); // or tf.maximum(a, b)\n * @param a The first tensor.\n * @param b The second tensor. Must have the same type as `a`.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction maximum<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let \$a = convertToTensor(a, 'a', 'maximum');\n let \$b = convertToTensor(b, 'b', 'maximum');\n [\$a, \$b] = makeTypesMatch(\$a, \$b);\n\n if (\$a.dtype === 'bool') {\n \$a = cast(\$a, 'int32');\n \$b = cast(\$b, 'int32');\n }\n\n assertAndGetBroadcastShape(\$a.shape, \$b.shape);\n\n const inputs: MaximumInputs = {a: \$a, b: \$b};\n\n return ENGINE.runKernel(Maximum, inputs as {} as NamedTensorMap);\n}\n\nexport const maximum = op({maximum_});\n", "/*\n *
@license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====

*\n\nimport {ENGINE} from './engine';\nimport {Mean, MeanAttrs, MeanInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes the mean of elements across dimensions of a `tf.Tensor`.\n * Reduces `x` along the dimensions given in `axis`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axis`.\n * If `keepDims` is true, the reduced dimensions are retained with length 1.\n * If `axis` has no entries, all dimensions are reduced, and a `tf.Tensor` with a single element is returned.\n * `js`\n * const x = tf.tensor1d([1, 2, 3]);\n * x.mean().print(); // or tf.mean(a)\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.mean(axis).print(); // or tf.mean(x, axis)\n * @param x The input tensor.\n * @param axis The dimension(s) to reduce. By default it reduces all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction mean<T extends Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const \$x = convertToTensor(x, 'x', 'mean');\n\n const inputs: MeanInputs = {x: \$x};\n\n return ENGINE.runKernel(Mean, inputs as {} as NamedTensorMap);\n}\n\nexport const mean = op({mean_});\n", "/*\n *
@license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====

```

const attrs: MeanAttrs = {axis, keepDims};\n\n return ENGINE.runKernel(\n    Mean, inputs
as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const mean = op({mean_});\n", "/**\n *
@license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0
(the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\nimport {ENGINE} from './engine';\nimport {Min, MinAttrs, MinInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes the minimum value from the
input.\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the
array is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with
length 1.\n * If `axes` has no entries, all dimensions are reduced, and an array with a\n * single element is
returned.\n *  

`js`\n * const x = tf.tensor1d([1, 2, 3]);\n * x.min().print(); // or tf.min(x)\n *  

`js`\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.min(axis).print(); // or tf.min(x, axis)\n *
`js`\n * @param x The input Tensor.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all
dimensions.\n * @param keepDims If true, retains reduced dimensions
with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n\nfunction min_<T extends
Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n  const $x =
convertToTensor(x, 'x', 'min');\n\n  const inputs: MinInputs = {x: $x};\n  const attrs: MinAttrs = {axis,
keepDims};\n\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  return ENGINE.runKernel(\n
Min, inputs as { } as NamedTensorMap,\n      attrs as { } as NamedAttrMap) as T;\n}\n\nexport const min =
op({min_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS
IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport {Minimum, MinimumInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
 './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {cast} from './cast';\nimport {op} from
 './operation';\n\n/**\n * Returns the min of a and b (a < b ? a : b) element-wise.\n * Supports broadcasting.\n * We also expose `minimumStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the
same shape (does not broadcast).\n *  

`js`\n * const
a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n * a.minimum(b).print(); // or
tf.minimum(a, b)\n *  

`js`\n * // Broadcast minimum a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n *
const b = tf.scalar(5);\n * a.minimum(b).print(); // or tf.minimum(a, b)\n *  

`js`\n * @param a The first
tensor.\n * @param b The second tensor. Must have the same type as `a`.\n * @doc {heading: 'Operations',
subheading: 'Arithmetic'}\n\nfunction minimum_<T extends Tensor>(\n  a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'minimum');\n  let $b = convertToTensor(b, 'b',
'minimum');\n  [$a, $b] = makeTypesMatch($a, $b);\n\n  if ($a.dtype === 'bool') {\n    $a = cast($a, 'int32');\n    $b =
cast($b, 'int32');\n  }\n\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n\n  const inputs: MinimumInputs = {a:

```



```

$a, b: $b};\n\n return ENGINE.runKernel(Minimum, inputs as {} as NamedTensorMap);\n\n\nexport const
  minimum = op({minimum_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
  Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
  compliance with the License.\n * You may obtain a copy of the License at\n *\n *
  http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport {ENGINE} from '../engine';\nimport {MirrorPad, MirrorPadAttrs, MirrorPadInputs} from
  '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
  {NamedTensorMap} from '../tensor_types';\nimport
  {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from
  './util';\nimport {op} from './operation';\n\n/**\n * Pads a `tf.Tensor` using mirror padding.\n *\n * This operation
  implements the `REFLECT` and `SYMMETRIC` modes of pad.\n *\n * ```js\n * const x = tf.range(0, 9).reshape([1,
  1, 3, 3]);\n * x.mirrorPad([[0, 0], [0, 0], [2, 2], [2, 2]], 'reflect').print();\n * ```\n *\n * @param x The tensor to pad.\n *
  @param paddings An array of length `R` (the rank of the tensor), where\n * each element is a length-2 tuple of ints
  `[padBefore, padAfter]`,\n * specifying how much to pad along each dimension of the tensor.\n * In `reflect`\n
  mode, the padded regions do not include the borders,\n * while in `symmetric` mode the padded regions do
  include the borders.\n * For example, if the input is `[1, 2, 3]` and paddings is `[0, 2]`,\n * then the output is
  `[1, 2, 3, 2, 1]` in `reflect` mode, and\n * `[1, 2, 3, 3, 2]` in `symmetric`\n
  mode.\n * If `mode` is `reflect` then both `paddings[D, 0]` and `paddings[D, 1]`\n * must be no greater than
  `x.shape[D] - 1`. If mode is `symmetric`\n * then both `paddings[D, 0]` and `paddings[D, 1]` must be no greater
  than\n * `x.shape[D]`\n * @param mode String to specify padding mode. Can be `reflect` | `symmetric`\n *\n/**
  @doc {heading: 'Tensors', subheading: 'Transformations'} *\nfunction mirrorPad_<T extends Tensor>(\n  x:
  T|TensorLike, paddings: Array<[number, number]>,\n  mode: 'reflect'|'symmetric'): T {\n  util.assert(\n    mode
  === 'reflect' || mode === 'symmetric',\n    () => `Invalid mode. Mode must be either reflect or symmetric.` +\n
  `Got ${mode}.`);\n\n  const $x = convertToTensor(x, 'x', 'mirrorPad');\n  if ($x.rank === 0) {\n    throw new Error(\n
    'mirrorPad(scalar) is not defined.' +\n    'Pass non-scalar to mirrorPad');\n  }\n  util.assert(\n
  paddings.length === $x.rank,\n    () => `Padding doesn't match input. Must
  be ${$x.rank}.` +\n    `Got ${paddings.length}.`);\n  const shapeOffset = mode === 'reflect' ? 1 : 0;\n  for (let i
  = 0; i < $x.rank; i++) {\n    util.assert(\n      paddings[i].length === 2,\n      () => `Invalid number of paddings.
  Must be length of 2 each.`);\n    util.assert(\n      paddings[i][0] >= 0 && paddings[i][0] <= $x.shape[i] -
  shapeOffset &&\n      paddings[i][1] >= 0 && paddings[i][1] <= $x.shape[i] - shapeOffset,\n      () => `Padding
  in dimension ${i} cannot be greater than or equal ` +\n      `to ${$x.shape[i] - shapeOffset} or less than 0 for
  input of ` +\n      `shape ${$x.shape}`);\n  }\n\n  const attrs: MirrorPadAttrs = {paddings, mode};\n  const inputs:
  MirrorPadInputs = {x: $x};\n  return ENGINE.runKernel(\n    MirrorPad, inputs as {} as NamedTensorMap, attrs
  as {} as NamedAttrMap);\n}\n\n\nexport const mirrorPad = op({mirrorPad_});\n", "/*\n * @license\n * Copyright
  2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
  License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
  may obtain a copy of the License at\n *\n *
  http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
  * distributed under the License is distributed on an \"AS IS\"
  BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
  specific language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport {ENGINE} from '../engine';\nimport {Mod, ModInputs} from '../kernel_names';\nimport {Tensor}
  from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
  './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
  
```

```

{op} from './operation';\n\n**\n * Returns the mod of
a and b element-wise.\n * `floor(x / y) * y + mod(x, y) = x`\n * Supports broadcasting.\n *\n * We also expose
`tf.modStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the same shape (does not
broadcast).\n *\n * ```js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n *\n * a.mod(b).print(); // or tf.mod(a, b)\n * ```\n *\n * ```js\n * // Broadcast a mod b.\n * const a = tf.tensor1d([2, 4, 6,
8]);\n * const b = tf.scalar(5);\n *\n * a.mod(b).print(); // or tf.mod(a, b)\n * ```\n *\n * @param a The first tensor.\n
* @param b The second tensor. Must have the same type as `a`.\n *\n * @doc {heading: 'Operations', subheading:
'Arithmetic'}\n *\nfunction mod_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =
convertToTensor(a, 'a', 'mod');\n let $b = convertToTensor(b, 'b', 'mod');\n [$a, $b] = makeTypesMatch($a, $b);\n\n
const inputs: ModInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Mod,
inputs as {} as NamedTensorMap);\n}\n\nexport const mod = op({mod_});\n"/**\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n**\n
* Computes square of `x` element-wise: `x ^ 2`\n *\n * ```js\n * const x = tf.tensor1d([1, 2, Math.sqrt(2), -1]);\n *\n
* x.square().print(); // or tf.square(x)\n * ```\n *\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\nfunction square_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'square');\n const attrs = {};\n return ENGINE.runKernel('Square', {x: $x,
attrs});\n}\n\nexport const square = op({square_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *

```

```

=====\n
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport {parseAxisParam} from './util';\n\nimport {expandShapeToKeepDim} from
'./axis_util';\nimport {cast} from './cast';\nimport {mean} from './mean';\nimport {op} from './operation';\nimport
{reshape} from './reshape';\nimport {square} from './square';\nimport {sub} from './sub';\n\n**\n
* Calculates the mean and variance of `x`. The mean and variance are\n * calculated by aggregating the contents of `x` across `axes`.
If `x` is\n * 1-D and `axes = [0]` this is just the mean and variance of a vector.\n *\n * @param x The input tensor.\n
* @param axis The dimension(s) along with to compute mean and\n * variance. By default
it reduces all dimensions.\n * @param keepDims If true, the moments have the same dimensionality as the\n *
input.\n * @return An object with two keys: `mean` and `variance`.\n *\n * @doc {heading: 'Operations',
subheading: 'Normalization'}\n *\nfunction moments_(\n x: Tensor|TensorLike, axis: number|number[] = null,\n
keepDims = false): {mean: Tensor, variance: Tensor} {\n x = convertToTensor(x, 'x', 'moments');\n const axes =
parseAxisParam(axis, x.shape);\n const xMean = mean(x, axes, keepDims);\n let keepDimsShape =
xMean.shape;\n if (!keepDims) {\n keepDimsShape = expandShapeToKeepDim(xMean.shape, axes);\n }\n\n
const devSquared =\n square(sub(cast(x, 'float32'), reshape(xMean, keepDimsShape)));\n const variance =
mean(devSquared, axes, keepDims);\n return {mean: xMean, variance};\n}\n\nexport const moments =

```

op({moments_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n

* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {Tensor2D} from './tensor';\nimport {convertToTensor, convertToTensorArray} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * @docalias (data: Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D]\n * \nexport type LSTMCellFunc = {\n (data: Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D];\n};\n\n/**\n * Computes the next states and outputs of a stack of LSTMCells.\n * \n * Each cell output is used as input to the next cell.\n * \n * Returns [cellState, cellOutput].\n * \n * Derived from tf.contrib.rnn.MultiRNNCell.\n * \n * @param lstmCells Array of LSTMCell functions.\n * @param data The input to the cell.\n * @param c Array of previous cell states.\n * @param h Array of previous cell outputs.\n * \n * @doc {heading: 'Operations', subheading: 'RNN'}\n */\nfunction multiRNNCell_(\n lstmCells: LSTMCellFunc[], data: Tensor2D|TensorLike,\n c: Array<Tensor2D|TensorLike>,\n h: Array<Tensor2D|TensorLike>): [Tensor2D[], Tensor2D[]] {\n const $data = convertToTensor(data, 'data', 'multiRNNCell');\n const $c = convertToTensorArray(c, 'c', 'multiRNNCell');\n const $h = convertToTensorArray(h, 'h', 'multiRNNCell');\n\n let input = $data;\n const newStates = [];\n for (let i = 0; i < lstmCells.length; i++) {\n const output = lstmCells[i](input, $c[i], $h[i]);\n newStates.push(output[0]);\n newStates.push(output[1]);\n\n input = output[1];\n }\n const newC: Tensor2D[] = [];\n const newH: Tensor2D[] = [];\n for (let i = 0; i < newStates.length; i += 2) {\n newC.push(newStates[i]);\n newH.push(newStates[i + 1]);\n }\n return [newC, newH];\n}\n\nexport const multiRNNCell = op({multiRNNCell_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Multinomial, MultinomialAttrs, MultinomialInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Creates a `tf.Tensor` with values drawn from a multinomial distribution.\n * \n * ``js\n * const probs = tf.tensor([.75, .25]);\n * tf.multinomial(probs, 3).print();\n * ``\n * \n * @param logits 1D array with unnormalized log-probabilities, or\n * 2D array of shape `[batchSize, numOutcomes]`. See the `normalized`\n * parameter.\n * @param numSamples Number of samples to draw for each row slice.\n * @param seed The seed number.\n * @param normalized Whether the provided `logits` are normalized true\n * probabilities (sum to 1). Defaults to false.\n * @return 1D array of shape `[numSamples]`, or 2D array of shape\n * `[batchSize, numSamples]`, depending on the rank of the input.\n * \n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction multinomial_(\n logits: Tensor1D|Tensor2D|TensorLike, numSamples: number, seed?:\n number,\n normalized = false): Tensor1D|Tensor2D {\n const $logits = convertToTensor(logits, 'logits', 'multinomial');\n const numOutcomes = $logits.size;\n const origRank = $logits.rank;\n if (numOutcomes < 2) {\n throw new Error(\n `Error in multinomial: you need at least 2 outcomes, but got ` +\n `${numOutcomes}.`);\n }\n if (origRank > 2) {\n throw new Error(`Rank of probabilities must be 1 or 2, but is`
```

```

${origRank}));\n }\n // TODO(linal28): Investigate correct seed behavior. The code seems not allow\n // setting
see to 0.\n seed = seed || Math.random();\n\n // The kernel only accepts (and returns) rank 2 tensors.\n const
logits2D: Tensor2D =\n   origRank === 1 ? reshape($logits, [1, -1]) : $logits as Tensor2D;\n\n const inputs:
MultinomialInputs = {logits: logits2D};\n const attrs: MultinomialAttrs = {numSamples, seed, normalized};\n\n //
tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n   Multinomial,
inputs as {} as NamedTensorMap,\n   attrs as {} as NamedAttrMap) as Tensor2D;\n\n // tslint:disable-
next-line: no-unnecessary-type-assertion\n return origRank === 1 ? reshape(res, [res.size]) as Tensor1D :
res;\n}\n\nexport const multinomial = op({multinomial_});\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {ENGINE} from './engine';\nimport {NotEqual, NotEqualInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth
value of (a != b) element-wise. Supports broadcasting.\n * \n * \n * const a = tf.tensor1d([1, 2, 3]);\n * const b =
tf.tensor1d([0, 2, 3]);\n * \n * a.notEqual(b).print();\n * \n * @param a
The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n * \n * @doc
{heading: 'Operations', subheading: 'Logical'}\n */\nfunction notEqual<T extends Tensor>(\n  a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'notEqual');\n  let $b =
convertToTensor(b, 'b', 'notEqual');\n  [$a, $b] = makeTypesMatch($a, $b);\n\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  const inputs: NotEqualInputs = {a: $a, b: $b};\n  return
ENGINE.runKernel(NotEqual, inputs as {} as NamedTensorMap);\n}\n\nexport const notEqual =
op({notEqual_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n *
distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap}
from './types';\nimport {makeZerosTypedArray, sizeFromShape} from './util';\nimport {complex} from
'./complex';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 0.\n * \n * \n * tf.zeros([2, 2]).print();\n *
\n * \n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The type of an
element in the resulting tensor. Can\n *   be 'float32', 'int32' or 'bool'. Defaults to 'float'.\n * \n * @doc {heading:
'Tensors', subheading: 'Creation'}\n */\nexport function zeros<R extends Rank>(\n  shape: ShapeMap[R],
dtype: DataType = 'float32'): Tensor<R> {\n  if (dtype === 'complex64') {\n    const real = zeros(shape, 'float32');\n    const imag = zeros(shape, 'float32');\n    return complex(real, imag);\n  }\n  const values =
makeZerosTypedArray(sizeFromShape(shape), dtype);\n  return ENGINE.makeTensor(values, shape, dtype) as
Tensor<R>;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed

```

on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {makeOnesTypedArray, sizeFromShape} from './util';\nimport {complex} from './complex';\nimport {zeros} from './zeros';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 1.\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The type of an element in the resulting tensor. Defaults to\n *   'float'.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function ones<R extends Rank>(\n  shape: ShapeMap[R], dtype: DataType = 'float32'):\n  Tensor<R> {\n  if (dtype === 'complex64') {\n    const real = ones(shape, 'float32');\n    const imag = zeros(shape, 'float32');\n    return complex(real, imag);\n  }\n  const values =\n    makeOnesTypedArray(sizeFromShape(shape), dtype);\n  return\n    ENGINE.makeTensor(values, shape, dtype) as Tensor<R>;\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {OnesLike, OnesLikeInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 1 with the same shape as the\n * given tensor.\n *\n * const x =\n *   tf.tensor([1, 2]);\n *   tf.onesLike(x).print();\n *\n * @param x A tensor.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function onesLike_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =\n    convertToTensor(x, 'x', 'onesLike');\n  const inputs: OnesLikeInputs = {x: $x};\n  return\n    ENGINE.runKernel(OnesLike, inputs as { } as NamedTensorMap);\n}\n\nexport const onesLike =\n  op({onesLike_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed\n * to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {matMul} from './mat_mul';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the outer product of two vectors, `v1` and `v2`.\n *\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([3, 4, 5]);\n *\n * tf.outerProduct(a, b).print();\n *\n * @param v1 The first vector in the outer product operation.\n * @param v2 The second vector in the outer product operation.\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n */\nexport function outerProduct_ (\n  v1: Tensor1D|TensorLike, v2: Tensor1D|TensorLike): Tensor2D {\n  const $v1 = convertToTensor(v1, 'v1', 'outerProduct');\n  const $v2 =\n    convertToTensor(v2, 'v2', 'outerProduct');\n  util.assert(\n    $v1.rank === 1 && $v2.rank === 1,\n    () =>\n      `Error in outerProduct: inputs must be rank 1, but got ranks ` +\n        `${$v1.rank} and `${$v2.rank}`.`);\n  const v12D = reshape($v1, [-1, 1]);\n  const v22D = reshape($v2, [1, -1]);\n  return matMul(v12D, v22D);\n}\n\nexport\n
```

```

const outerProduct = op({outerProduct_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under
the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {PadV2, PadV2Attrs, PadV2Inputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Pads a `tf.Tensor` with a given value and
padding.\n *\n * This operation implements `CONSTANT` mode. For `REFLECT` and `SYMMETRIC`,\n * refer
to `tf.mirrorPad`\n *\n * Also available are stricter rank-specific methods with the same signature\n *
as this method that assert that `padding` is of given
length.\n * - `tf.pad1d`\n * - `tf.pad2d`\n * - `tf.pad3d`\n * - `tf.pad4d`\n *\n * ``js\n * const x = tf.tensor1d([1,
2, 3, 4]);\n * x.pad([[1, 2]]).print();\n * ``\n *\n * @param x The tensor to pad.\n * @param padding An array of
length `R` (the rank of the tensor), where\n * each element is a length-2 tuple of ints `[padBefore, padAfter]`,\n *
specifying how much to pad along each dimension of the tensor.\n * @param constantValue The pad value to use.
Defaults to 0.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n *\nfunction pad_<T extends
Tensor>(\n  x: T|TensorLike, padding: Array<[number, number]>, constantValue = 0): T {\n  const $x =
convertToTensor(x, 'x', 'pad');\n  if ($x.rank === 0) {\n    throw new Error('pad(scalar) is not defined. Pass non-
scalar to pad');\n  }\n\n  const attrs: PadV2Attrs = {padding, constantValue};\n  const inputs: PadV2Inputs = {x:
$x};\n  return ENGINE.runKernel(\n    PadV2, inputs as unknown as NamedTensorMap,\n    attrs as unknown as NamedAttrMap);\n  }\n\nexport const pad = op({pad_});\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor1D} from '../tensor';\nimport {TensorLike} from '../types';\nimport {assert} from '../util';\nimport
{op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor1D`\n * with a given value and padding. See `pad` for details.\n *\nfunction pad1d_(\n  x: Tensor1D|TensorLike,
padding: [number, number],\n  constantValue = 0): Tensor1D {\n  assert(\n    padding.length === 2,\n    () =>
'Invalid number of paddings. Must be length of 2.);\n  return pad(x, [padding], constantValue);\n  }\n\nexport const
pad1d = op({pad1d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {Tensor2D} from '../tensor';\nimport {TensorLike} from '../types';\nimport {assert} from '../util';\nimport
{op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor2D` with a given value and

```

paddings. See `pad` for details.\n *\nfunction pad2d(\n x: Tensor2D|TensorLike, paddings: [[number, number], [number, number]],\n constantValue = 0): Tensor2D {\n assert(\n paddings.length === 2 &&\n paddings[0].length === 2 &&\n paddings[1].length === 2,\n () => 'Invalid number of paddings. Must be length of 2 each.);\n return pad(x, paddings, constantValue);\n}\n\nexport const pad2d = op({pad2d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License

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```
=====\n*\nimport {Tensor3D} from './tensor';\nimport {TensorLike} from './types';\nimport {assert} from './util';\nimport {op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor3D` with a given value and paddings. See `pad` for details.\n *\nfunction pad3d(\n x: Tensor3D|TensorLike,\n paddings: [[number, number], [number, number], [number, number]],\n constantValue = 0): Tensor3D {\n assert(\n paddings.length === 3 && paddings[0].length === 2 &&\n paddings[1].length === 2 &&\n paddings[2].length === 2,\n () => 'Invalid number of paddings. Must be length of 2 each.);\n return pad(x, paddings, constantValue);\n}\n\nexport const pad3d = op({pad3d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {Tensor4D} from './tensor';\nimport {TensorLike} from './types';\nimport {assert} from './util';\nimport {op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor4D` with a given value and paddings. See `pad` for details.\n *\nfunction pad4d(\n x: Tensor4D|TensorLike,\n paddings: [\n [number, number], [number, number], [number, number], [number, number]\n ],\n constantValue = 0): Tensor4D {\n assert(\n paddings.length === 4 && paddings[0].length === 2 &&\n paddings[1].length === 2 && paddings[2].length === 2 &&\n paddings[3].length === 2,\n () => 'Invalid number of paddings. Must be length of 2 each.);\n return pad(x, paddings, constantValue);\n}\n\nexport const pad4d = op({pad4d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * This operation divides "spatial" dimensions `[1, ..., M]` of the input into\n * a grid of blocks of shape `blockShape`, and interleaves
```

these blocks with the "batch" dimension (0) such that in the output, the spatial dimensions [1, ..., M] correspond to the position within the grid and the batch dimension combines both the position within a spatial block and the original batch position. Prior to division into blocks, the spatial dimensions of the input are optionally zero padded according to paddings. See below for a precise description.

```

tf.tensor4d([1, 2, 3, 4], [1, 2, 2, 1]);
const blockSize = [2, 2];
const paddings = [[0, 0], [0, 0]];
x.spaceToBatchND(blockShape, paddings).print();

```

N-D with x.shape = [batch] + spatialShape + remainingShape, where spatialShape has M dimensions. @param blockSize A 1-D array. Must have shape [M], all values must be >= 1. @param paddings A 2-D array. Must have shape [M, 2], all values must be >= 0. paddings[i] = [padStart, padEnd] specifies

the amount to zero-pad from input dimension i + 1, which corresponds to spatial dimension i. It is required that (inputShape[i + 1] + padStart + padEnd) % blockSize[i] === 0. This operation is equivalent to the following steps:

- Zero-pad the start and end of dimensions [1, ..., M] of the input according to paddings to produce padded of shape paddedShape.
- Reshape padded to reshapedPadded of shape: [batch] + [paddedShape[1] / blockSize[0], blockSize[0], ..., paddedShape[M] / blockSize[M-1], blockSize[M-1]] + remainingShape.
- Permute dimensions of reshapedPadded to produce permutedReshapedPadded of shape: blockSize + [batch] + [paddedShape[1] / blockSize[0], ..., paddedShape[M] / blockSize[M-1]] + remainingShape.
- Reshape permutedReshapedPadded to flatten blockSize into the batch dimension, producing an output tensor of shape: [batch * prod(blockShape)] + [paddedShape[1] / blockSize[0], ..., paddedShape[M] / blockSize[M-1]] + remainingShape.

```

@doc {heading: 'Tensors',
subheading: 'Transformations'}
function spaceToBatchND_<T extends Tensor>(
  x: T|TensorLike,
  blockSize: number[],
  paddings: number[][]): T {
  const $x = convertToTensor(x, 'x', 'spaceToBatchND');
  util.assert($x.rank >= 1 + blockSize.length,
    () => `input rank ${$x.rank} should be > than [blockSize]
    ${blockSize.length}`);
  util.assert(paddings.length === blockSize.length,
    () => `paddings.shape[0] ${paddings.length} must be equal to [blockSize]
    ${blockSize.length}`);
  util.assert($x.shape.reduce((a, b, i) => {
    if (i > 0 && i <= blockSize.length) {
      return a && ((b + paddings[i - 1][0] + paddings[i - 1][1]) %
        blockSize[i - 1] === 0);
    }
    return a;
  }, true),
    () => `input spatial dimensions ${$x.shape.slice(1)} with paddings
    ${paddings.toString()} must be divisible by blockShapes
    ${blockSize.toString()}`);
  const inputs: SpaceToBatchNDInputs = {x: $x};
  const attrs: SpaceToBatchNDAttrs = {blockSize, paddings};
  return ENGINE.runKernel(spaceToBatchND, inputs as {} as NamedTensorMap,
    attrs as {} as NamedAttrMap);
}
export const spaceToBatchND = op({spaceToBatchND_});

```

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```

=====
import {Tensor3D, Tensor4D} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import * as util from './util';
import {avgPool} from './avg_pool';
import {batchToSpaceND} from './batch_to_space_nd';
import * as conv_util from './conv_util';
import {maxPool} from './max_pool';
import {op} from './operation';
import {reshape} from './reshape';
import {spaceToBatchND} from './space_to_batch_nd';

```

Performs an N-D pooling operation. @param input The input tensor, of rank 4 or rank 3 of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed. @param windowShape The filter size: [filterHeight, filterWidth]. If filterSize is a single number,

then `filterHeight == filterWidth`.\n * @param poolingType The type of pooling, either 'max' or 'avg'.\n * @param pad The type of padding algorithm:\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n * in dilated pooling. Defaults to `[1, 1]`. If `dilationRate` is a single\n * number, then `dilationHeight == dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n * @param strides The strides of the pooling: `[strideHeight, strideWidth]`. If\n * `strides` is a single number, then `strideHeight == strideWidth`.\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n * ^\nfunction pool_<T extends Tensor3D|Tensor4D>(\n input: T|TensorLike, windowShape: [number, number]number,\n poolingType: 'avg'|'max', pad: 'valid'|'same'|number,\n dilations?: [number, number]number, strides?: [number, number]number) {\n if (dilations == null) {\n dilations = [1, 1];\n }\n if (strides == null) {\n strides = 1;\n }\n if (pad === 0) {\n pad = 'valid';\n }\n\n const \$x = convertToTensor(input, 'x', 'maxPool');\n let x4D = \$x as Tensor4D;\n let reshapedTo4D = false;\n\n if (\$x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape(\$x, [1, \$x.shape[0], \$x.shape[1], \$x.shape[2]]);\n }\n\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => 'Error in pool: Either strides or dilations must be 1. ' +\n `Got strides \${strides} and dilations \${dilations}`);\n\n const convInfo = conv_util.computePool2DInfo(\n x4D.shape, windowShape, strides, dilations, pad);\n const dilation: [number, number] = [convInfo.dilationHeight, convInfo.dilationWidth];\n\n // The following implementation does batchToSpace(pool(spaceToBatch(x)))\n // whenever dilation > 1 since the TF kernels do not support dilation > 1.\n // tslint:disable-next-line:max-line-length\n\n https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/nn_ops.py#L1037\n\n let basePadding: number[][];\n if (pad === 'same') {\n basePadding = withSpaceToBatchBasePaddings(\n [convInfo.filterHeight, convInfo.filterWidth], dilation);\n } else {\n basePadding = [[0, 0], [0, 0]];\n }\n\n const isDilationOne = dilation[0] === 1 && dilation[1] === 1;\n const [adjustedPadding, adjustedCrops] = requiredSpaceToBatchPaddings(\n [convInfo.inHeight, convInfo.inWidth], dilation, basePadding);\n\n const convertedPad = isDilationOne ? pad : 'valid';\n const convertedX =\n isDilationOne ? x4D : spaceToBatchND(x4D, dilation, adjustedPadding);\n\n const forwardOp = poolingType === 'avg' ?\n () => avgPool(convertedX, windowShape, strides, convertedPad) :\n () => maxPool(convertedX, windowShape, strides, convertedPad);\n\n const y = forwardOp();\n\n const res = isDilationOne ? y : batchToSpaceND(y, dilation, adjustedCrops);\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n\n return res as T;\n}\n\n// Helper function to compute crops and paddings for pool with dilation > 1.\n// tslint:disable-next-line:max-line-length\n\n https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/array_ops.py#L2184\n\nfunction requiredSpaceToBatchPaddings(\n inputShape: [number, number], blockShape: [number, number],\n basePadding: number[][]) {\n const padStart = basePadding.map(b => b[0]);\n const origPadEnd = basePadding.map(b => b[1]);\n\n const fullInputShape = inputShape.concat(padStart, origPadEnd);\n\n const padEndExtra = blockShape.map((b, i) => (b - fullInputShape[i] % b) % b);\n\n const padEnd = origPadEnd.map((s, i) => s + padEndExtra[i]);\n\n const paddings = blockShape.map((_, i) => [padStart[i], padEnd[i]]);\n\n const crops = blockShape.map((_, i) => [0, padEndExtra[i]]);\n\n return [paddings, crops];\n}\n\n// Helper function to compute base paddings for pool with dilation > 1.\n// tslint:disable-next-line:max-line-length\n\n https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/nn_ops.py#L524\n\nfunction withSpaceToBatchBasePaddings(\n filterShape: [number, number], dilation: [number, number]) {\n // Spatial dimensions of the filters and the upsampled filters in which we\n // introduce (rate - 1) zeros between consecutive filter values.\n const dilatedFilterShape = filterShape.map((s, i) => {\n return s +

```

(s - 1)
* (dilation[i] - 1);n }));n const padExtraShape = dilatedFilterShape.map(s => s - 1);n // When padding is odd,
we pad more at end, following the same // convention as conv2d.n const padExtraStart = padExtraShape.map(s
=> Math.floor(s / 2));n const padExtraEnd = padExtraShape.map((s, i) => s - padExtraStart[i]);n return
padExtraShape.map(_, i) => {n return [padExtraStart[i], padExtraEnd[i]];n });n\n\nexport const pool =
op({pool_});n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====n
*\nimport {ENGINE} from './engine';\nimport {Pow, PowInputs} from './kernel_names';\nimport {Tensor} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';n\nimport
{op} from './operation';n\n**\n * Computes the power of one `tf.Tensor` to another. Supports broadcasting.\n * \n *
Given a `tf.Tensor` x and a `tf.Tensor` y, this operation computes x^y for\n * corresponding elements in x and y.
The result's dtype will be the upcasted\n * type of the `base` and `exp` dtypes.\n * \n * ``s\n * const a =
tf.tensor([[2, 3], [4, 5]])\n * const b = tf.tensor([[1, 2], [3, 0]]).toInt();n * \n * a.pow(b).print(); // or tf.pow(a, b)\n *
``\n * \n * ``s\n * const
a = tf.tensor([[1, 2], [3, 4]])\n * const b = tf.tensor(2).toInt();n * \n * a.pow(b).print(); // or tf.pow(a, b)\n *
``\n *
We also expose `powStrict` which has the same signature as this op and\n * asserts that `base` and `exp` are the
same shape (does not broadcast).\n * \n * @param base The base `tf.Tensor` to pow element-wise.\n * @param exp
The exponent `tf.Tensor` to pow element-wise.\n * \n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n
*\nfunction pow_<T extends Tensor>(n base: Tensor|TensorLike, exp: Tensor|TensorLike): T {\n let $base =
convertToTensor(base, 'base', 'pow');\n let $exp = convertToTensor(exp, 'exp', 'pow');\n [$base, $exp] =
makeTypesMatch($base, $exp);\n\n const inputs: PowInputs = {a: $base, b: $exp};\n\n return
ENGINE.runKernel(Pow, inputs as {} as NamedTensorMap);\n}\n\nexport const pow = op({pow_});n", "/*\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====n
*\n\nimport {ENGINE} from './engine';\nimport {Prelu, PreluInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';n\nimport {op} from './operation';n\n**\n * Computes
leaky rectified linear element-wise with parametric alphas.\n * \n * `x < 0 ? alpha * x` :
f(x) = x\n * \n * ``s\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n * const alpha = tf.scalar(0.1);\n * \n *
x.prelu(alpha).print(); // or tf.prelu(x, alpha)\n * ``\n * @param x The input tensor.\n * @param alpha Scaling
factor for negative values.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
*\nfunction prelu_<T
extends Tensor>(x: T|TensorLike, alpha: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'prelu');\n const
$alpha = convertToTensor(alpha, 'alpha', 'prelu');\n\n const inputs: PreluInputs = {x: $x, alpha: $alpha};\n return
ENGINE.runKernel(Prelu, inputs as {} as NamedTensorMap);\n}\n\nexport const prelu = op({prelu_});n", "/*\n *
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```

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```
=====
*import {ENGINE} from './engine';import {Prod, ProdAttrs, ProdInputs} from './kernel_names';import
{NamedAttrMap} from './kernel_registry';import {Tensor} from './tensor';import {NamedTensorMap} from
 './tensor_types';import {convertToTensor} from './tensor_util_env';import {TensorLike} from
 './types';import {cast} from './cast';import {op} from './operation';
* Computes the product of
elements across dimensions of a `tf.Tensor`.
* Reduces the input along the dimensions given in `axes`. Unless
`keepDims` is true, the rank of the `tf.Tensor` is reduced by
1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with
length 1. If `axes`
has no entries, all dimensions are reduced, and a `tf.Tensor` with a single element is returned.
const x = tf.tensor1d([1, 2, 3]);
x.prod().print(); // or tf.prod(x)
const x =
tf.tensor2d([1, 2, 3, 4], [2, 2]);
const axis = 1;
x.prod(axis).print(); // or tf.prod(x, axis)
@param x The input tensor to compute the product over. If the dtype is `bool` it will be converted to `int32`
and the output dtype will be `int32`.
@param axis The dimension(s) to reduce. By default it reduces
all
dimensions.
@param keepDims If true, retains reduced dimensions with size 1.
@doc {heading:
'Operations', subheading: 'Reduction'}
function prod<T extends Tensor>(
  x: Tensor|TensorLike, axis:
number|number[] = null, keepDims = false): T {
  let $x = convertToTensor(x,
  'x', 'prod');
  if ($x.dtype === 'bool') {
    // bool is not an allowed type for the underlying kernel.
    $x =
    cast($x, 'int32');
  }
  const inputs: ProdInputs = {x: $x};
  const attrs: ProdAttrs = {axis, keepDims};
  return ENGINE.runKernel(
    Prod, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap);
}
export const prod = op({prod_});
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OR CONDITIONS OF ANY KIND, either express or implied.
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under the License.

```

```
=====
*import {ENGINE} from './engine';import {Tensor} from './tensor';import {DataType, Rank, ShapeMap}
from './types';import {sizeFromShape} from './util';import {op} from './operation';
* Creates a
`tf.Tensor` with values sampled from a random number generator
* function defined by the user.
@param shape An array of integers defining the output tensor shape.
@param randFunction A random number generator
function which is called
* for each element in the output tensor.
@param dtype The data type of the output
tensor. Defaults to 'float32'.
function rand<R extends Rank>(
  shape: ShapeMap[R], randFunction: () =>
number,
  dtype?: DataType): Tensor<R> {
  const size = sizeFromShape(shape);
  let values = null;
  if (dtype
  == null || dtype === 'float32') {
    values = new Float32Array(size);
  } else if (dtype === 'int32') {
    values = new Int32Array(size);
  } else if (dtype === 'bool') {
    values = new Uint8Array(size);
  } else {
    throw new Error(`Unknown data type ${dtype}`);
  }
  for (let i = 0; i < size; i++) {
    values[i] =
    randFunction();
  }
  return ENGINE.makeTensor(values, shape, dtype) as Tensor<R>;
}
export const rand =
op({rand_});
// A port of an algorithm by Johannes Baagøe <baagoe@baagoe.com>, 2010
http://baagoe.com/en/RandomMusings/javascript/
https://github.com/nquinlan/better-random-numbers-for-javascript-mirror
Original work is under MIT license -
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```

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```
(function(global, module, define)
{\n\nfunction Alea(seed) {\n  var me = this, mash = Mash();\n  me.next = function() {\n    var t = 2091639 * me.s0\n    + me.c * 2.3283064365386963e-10; // 2^-32\n    me.s0 = me.s1;\n    me.s1 = me.s2;\n\n    return me.s2 = t - (me.c = t | 0);\n  };\n  // Apply the seeding algorithm from Baagoe.\n  me.c = 1;\n  me.s0 =\n  mash('');\n  me.s1 = mash('');\n  me.s2 = mash('');\n  me.s0 -= mash(seed);\n  if (me.s0 < 0) { me.s0 += 1; }\n  me.s1 -= mash(seed);\n  if (me.s1 < 0) { me.s1 += 1; }\n  me.s2 -= mash(seed);\n  if (me.s2 < 0) { me.s2 += 1; }\n  mash = null;\n}\n\nfunction copy(f, t) {\n  t.c = f.c;\n  t.s0 = f.s0;\n  t.s1 = f.s1;\n  t.s2 = f.s2;\n  return\n  t;\n}\n\nfunction impl(seed, opts) {\n  var xg = new Alea(seed),\n      state = opts && opts.state,\n      prng =\n      xg.next;\n  prng.int32 = function() { return (xg.next() * 0x100000000) | 0; }\n  prng.double = function() {\n    return\n    prng() + (prng() * 0x200000 | 0) * 1.1102230246251565e-16; // 2^-53\n  };\n  prng.quick = prng;\n  if (state) {\n    if (typeof(state) === 'object') copy(state, xg);\n    prng.state = function() { return copy(xg, {}); }\n  }\n  return\n  prng;\n}\n\nfunction Mash() {\n  var n = 0xefc8249d;\n  var mash = function(data) {\n    data = data.toString();\n    for (var i = 0; i < data.length; i++) {\n      n += data.charCodeAt(i);\n      var h =\n      0.02519603282416938 * n;\n      n = h >>> 0;\n      h -= n;\n      h *= n;\n      n = h >>> 0;\n      h -= n;\n      n += h * 0x100000000; // 2^32\n    }\n    return (n >>> 0) * 2.3283064365386963e-10; // 2^-32\n  };\n  return\n  mash;\n}\n\nif (module && module.exports) {\n  module.exports = impl;\n} else if (define && define.amd) {\n  define(function() { return impl; });\n} else {\n  this.alea = impl;\n}\n})(this, (typeof module) === 'object' &&\nmodule, // present in node.js\n(typeof define) === 'function' && define // present with an AMD\nloader);\n\n// A Javascript implementaion of the "xor128" prng algorithm by\n// George Marsaglia. See\nhttp://www.jstatsoft.org/v08/i14/paper\n\n(function(global, module, define) {\n\nfunction XorGen(seed) {\n  var me =\n  this, strseed = ";\n  me.x = 0;\n  me.y = 0;\n  me.z = 0;\n  me.w = 0;\n\n  // Set up generator function.\n  me.next = function() {\n    var t = me.x ^ (me.x << 11);\n    me.x = me.y;\n    me.y =\n    me.z;\n    me.z = me.w;\n    return me.w ^= (me.w >>> 19) ^ t ^ (t >>> 8);\n  };\n  if (seed === (seed | 0)) {\n    // Integer seed.\n    me.x = seed;\n  } else {\n    // String seed.\n    strseed += seed;\n  }\n  // Mix in string seed, then\n  discard an initial batch of 64 values.\n  for (var k = 0; k < strseed.length + 64; k++) {\n    me.x ^=\n    strseed.charCodeAt(k) | 0;\n    me.next();\n  }\n}\n\nfunction copy(f, t) {\n  t.x = f.x;\n  t.y = f.y;\n  t.z = f.z;\n  t.w =\n  f.w;\n  return t;\n}\n\nfunction impl(seed, opts) {\n  var xg = new XorGen(seed),\n      state = opts && opts.state,\n      prng =\n      function() { return (xg.next() >>> 0) / 0x100000000; };\n  prng.double = function() {\n    do {\n      var top =\n      xg.next() >>> 11,\n          bot = (xg.next() >>> 0) / 0x100000000,\n          result = (top + bot) / (1 << 21);\n    } while\n    (result === 0);\n    return\n    result;\n  };\n  prng.int32 = xg.next;\n  prng.quick = prng;\n  if (state) {\n    if (typeof(state) === 'object') copy(state,\n    xg);\n    prng.state = function() { return copy(xg, {}); }\n  }\n  return prng;\n}\n\nif (module && module.exports) {\n  module.exports = impl;\n} else if (define && define.amd) {\n  define(function() { return impl; });\n} else {\n  this.xor128 = impl;\n}\n})(this, (typeof module) === 'object' && module, // present in node.js\n(typeof define) === 'function' && define // present with an AMD loader);\n\n// A Javascript implementaion of the\n"\"xorwow\" prng algorithm by\n// George Marsaglia. See\nhttp://www.jstatsoft.org/v08/i14/paper\n\n(function(global, module, define) {\n\nfunction XorGen(seed) {\n  var me =
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= this, strseed = "";
// Set up generator function.
me.next = function() {
  var t = (me.x ^ (me.x >>> 2));
  me.x = me.y; me.y = me.z; me.z = me.w; me.w = me.v;
  return (me.d = (me.d + 362437 | 0)) + (me.v =
  (me.v
  ^ (me.v << 4)) ^ (t ^ (t << 1))) | 0);
  me.x = 0; me.y = 0; me.z = 0; me.w = 0; me.v = 0;
  if (seed === (seed | 0)) {
    // Integer seed.
    me.x = seed;
  } else {
    // String seed.
    strseed += seed;
  }
  // Mix in string seed, then discard an initial batch of 64 values.
  for (var k = 0; k < strseed.length + 64; k++) {
    me.x ^= strseed.charCodeAt(k) | 0;
    if (k === strseed.length) {
      me.d = me.x << 10 ^ me.x >>> 4;
    }
    me.next();
  }
}
function copy(f, t) {
  t.x = f.x; t.y = f.y; t.z = f.z; t.w = f.w; t.v = f.v; t.d = f.d;
  return t;
}
function impl(seed, opts) {
  var xg = new XorGen(seed),
      state = opts && opts.state,
      prng = function() {
        return (xg.next() >>> 0) / 0x100000000;
      };
  prng.double = function() {
    do {
      var top = xg.next() >>> 11,
          bot = (xg.next() >>> 0) / 0x100000000,
          result = (top + bot) / (1 << 21);
    } while (result === 0);
    return result;
  };
  prng.int32 = xg.next;
  prng.quick = prng;
  if (state) {
    if (typeof(state) === 'object')
      copy(state, xg);
    prng.state = function() {
      return copy(xg, {});
    };
  }
  return prng;
}
if (module && module.exports) {
  module.exports = impl;
} else if (define && define.amd) {
  define(function() {
    return impl;
  });
} else {
  this.xorwow = impl;
}
(this, (typeof module) === 'object' && module, // present in
node.js
(typeof define) === 'function' && define // present with an AMD loader
)
// A Javascript implementaion of the "xorshift7" algorithm by
// François Panneton and Pierre L'ecuyer:
// "On the Xorshift
Random Number Generators"
http://saluc.engr.uconn.edu/refs/crypto/rng/panneton05onthexorshift.pdf
(function(global, module, define) {
  function XorGen(seed) {
    var me = this;
    // Set up generator function.
    me.next = function() {
      // Update xor generator.
      var X = me.x, i = me.i, t,
          v, w;
      t = X[i]; t ^= (t >>> 7); v = t ^ (t << 24);
      t = X[(i + 1) & 7]; v ^= t ^ (t >>> 10);
      t = X[(i + 3) & 7]; v ^= t ^ (t >>> 3);
      t = X[(i + 4) & 7]; v ^= t ^ (t << 7);
      t = X[(i + 7) & 7]; t = t ^ (t << 13); v ^= t ^ (t << 9);
      X[i] = v; me.i = (i + 1) & 7; return v;
    };
    function init(me, seed) {
      var j, w, X = [];
      if (seed === (seed | 0)) {
        // Seed state array using a 32-bit integer.
        w = X[0] = seed;
      } else {
        // Seed state using a string.
        seed = "" + seed;
        for (j = 0; j < seed.length; ++j) {
          X[j & 7] = (X[j & 7] << 15) ^ (seed.charCodeAt(j) + X[(j + 1) & 7] << 13);
        }
        // Enforce an array length of 8, not all zeroes.
        while (X.length < 8) X.push(0);
        for (j = 0; j < 8 && X[j] === 0; ++j);
        if (j === 8) w = X[7] = -1; else w = X[j];
      }
      me.x = X; me.i = 0;
      // Discard an initial 256 values.
      for (j = 256; j > 0; --j) {
        me.next();
      }
    }
    init(me, seed);
  }
  function copy(f, t) {
    t.x = f.x.slice(); t.i = f.i;
    return t;
  }
  function impl(seed, opts) {
    if (seed === null) seed = +(new Date);
    var xg = new XorGen(seed),
        state = opts && opts.state,
        prng = function() {
          return (xg.next() >>> 0) / 0x100000000;
        };
    prng.double = function() {
      do {
        var top = xg.next() >>> 11,
            bot = (xg.next() >>> 0) / 0x100000000,
            result = (top + bot) / (1 << 21);
      } while (result === 0);
      return result;
    };
    prng.int32 = xg.next;
    prng.quick = prng;
    if (state) {
      if (state.x) copy(state, xg);
      prng.state = function() {
        return copy(xg, {});
      };
    }
    return prng;
  }
  if (module && module.exports) {
    module.exports = impl;
  } else if (define && define.amd) {
    define(function() {
      return impl;
    });
  } else {
    this.xorshift7 = impl;
  }
}
(this, (typeof module) === 'object' && module, // present in node.js
(typeof define) === 'function' && define // present with an AMD loader
)
// A Javascript implementaion of
Richard Brent's Xorgens xor4096 algorithm.
// This fast non-cryptographic random number generator is
designed for
// use in Monte-Carlo algorithms. It combines a long-period xorshift
generator with a Weyl
generator, and it passes all common batteries
of stastical tests for randomness while consuming only a few
nanoseconds
for each prng generated. For background on the generator, see Brent's
paper: "Some long-
period random number generators using shifts and xors."
http://arxiv.org/pdf/1004.3115v1.pdf
Usage:
var xor4096 = require('xor4096');
random = xor4096(1); // Seed with int32 or
string.
assert.equal(random(), 0.1520436450538547); // (0, 1) range, 53 bits.
assert.equal(random.int32(), 1806534897); // signed int32, 32 bits.
// For nonzero numeric keys, this impelementation provides a

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sequence identical to that by Brent's xorgens 3 implementation in C. This implementation also provides for initializing the generator with string seeds, or for saving and restoring the state of the generator. On Chrome, this prng benchmarks about 2.1 times slower than Javascript's built-in Math.random().

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(function(global, module, define) {
  function XorGen(seed) {
    var me = this;
    // Set up generator function.
    me.next = function() {
      var w = me.w, X = me.X, i = me.i, t, v;
      // Update Weyl generator.
      me.w = w = (w + 0x61c88647) | 0;
      // Update xor generator.
      v = X[(i + 34) & 127];
      t = X[(i + 1) & 127];
      v ^= v << 13;
      t ^= t << 17;
      v ^= v >>> 15;
      t ^= t >>> 12;
      // Update Xor generator array state.
      v = X[i] = v ^ t;
      me.i = i;
      // Result is the combination.
      return (v + (w ^ (w >>> 16))) | 0;
    };
    function init(me, seed) {
      var t, v, i, j, w, X = [], limit = 128;
      if (seed === (seed | 0)) {
        // Numeric seeds initialize v, which is used to generate X.
        v = seed;
        seed = null;
      } else {
        // String seeds are mixed into v and X one character at a time.
        seed = seed + '\0';
        v = 0;
        limit = Math.max(limit, seed.length);
      }
      // Initialize circular array and weyl value.
      for (i = 0, j = -32; j < limit; ++j) {
        // Put the unicode characters into the array, and shuffle them.
        if (seed) v ^= seed.charCodeAt((j + 32) % seed.length);
        // After 32 shuffles, take v as the starting w value.
        if (j === 0) w = v;
        v ^= v << 10;
        v ^= v >>> 15;
        v ^= v << 4;
        v ^= v >>> 13;
        if (j >= 0) {
          w = (w + 0x61c88647) | 0;
          // Weyl.
          t = (X[j & 127] ^ (v + w));
          // Combine xor and weyl to init array.
          i = (0 === t) ? i + 1 : 0;
          // Count zeroes.
        }
      }
      // We have detected all zeroes; make the key nonzero.
      if (i >= 128) {
        X[(seed && seed.length || 0) & 127] = -1;
      }
      // Run the generator 512 times to further mix the state before using it.
      // Factoring this as a function slows the main generator, so it is just unrolled here.
      // The weyl generator is not advanced while warming up.
      i = 127;
      for (j = 4 * 128; j > 0; --j) {
        v = X[(i + 34) & 127];
        t = X[(i + 1) & 127];
        v ^= v << 13;
        t ^= t << 17;
        v ^= v >>> 15;
        t ^= t >>> 12;
        X[i] = v ^ t;
      }
      // Storing state as object members is faster than using closure variables.
      me.w = w;
      me.X = X;
      me.i = i;
    }
    init(me, seed);
  }
  function copy(f, t) {
    t.i = f.i;
    t.w = f.w;
    t.X = f.X.slice();
    return t;
  }
  function impl(seed, opts) {
    if (seed == null) seed = +(new Date);
    var xg = new XorGen(seed),
        state = opts && opts.state,
        prng = function() { return (xg.next() >>> 0) / 0x100000000; };
    prng.double = function() {
      do {
        var top = xg.next() >>> 11,
            bot = (xg.next() >>> 0) / 0x100000000,
            result = (top + bot) / (1 << 21);
      } while (result === 0);
      return result;
    };
    prng.int32 = xg.next;
    prng.quick = prng;
    if (state) {
      if (state.X) copy(state, xg);
      prng.state = function() { return copy(xg, {}); };
    }
    return prng;
  }
  if (module && module.exports) {
    module.exports = impl;
  } else if (define && define.amd) {
    define(function() { return impl; });
  } else {
    this.xor4096 = impl;
  }
  (function(global, module, define) {
    function XorGen(seed) {
      var me = this, strseed = "";
      // Set up generator function.
      me.next = function() {
        var b = me.b, c = me.c, d = me.d, a = me.a;
        b = (b << 25) ^ (b >>> 7) ^ c;
        c = (c - d) | 0;
        d = (d << 24) ^ (d >>> 8) ^ a;
        a = (a - b) | 0;
        me.b = b = (b << 20) ^ (b >>> 12) ^ c;
        me.c = c = (c - d) | 0;
        me.d = (d << 16) ^ (c >>> 16) ^ a;
        return me.a = (a - b) | 0;
      };
      /* The following is non-inverted tyche, which has better internal * bit diffusion, but which is about 25% slower than tyche-i in JS.
      me.next = function() {
        var a = me.a, b = me.b, c = me.c, d = me.d;
        a = (me.a + me.b | 0) >>> 0;
        d = me.d ^ a;
        d = d << 16 ^ d >>> 16;
        c = me.c + d | 0;
        b = me.b ^ c;
        b = b << 12 ^ d >>> 20;
        me.a = a = a + b | 0;
        d = d ^ a;
        me.d = d = d << 8 ^ d >>> 24;
        me.c = c = c + d | 0;
        b = b ^ c;
        return me.b = (b << 7 ^ b >>> 25);
      };
      me.a = 0;
      me.b = 0;
      me.c = 2654435769
      | 0;
      me.d = 1367130551;
      if (seed === Math.floor(seed)) {
        // Integer seed.
        me.a = (seed / 0x100000000) | 0;
        me.b = seed | 0;
      } else {
        // String seed.
        strseed += seed;
      }
      // Mix in string seed, then discard an initial batch of 64 values.
      for (var k = 0; k < strseed.length + 20; k++) {
        me.b ^= strseed.charCodeAt(k) | 0;
        me.next();
      }
    }
    function copy(f, t) {
      t.a = f.a;
      t.b = f.b;
      t.c = f.c;
      t.d =

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f.d;\n return t;\n};\n\nfunction impl(seed, opts) {\n  var xg = new XorGen(seed),\n      state = opts && opts.state,\n      prng = function() { return (xg.next() >>> 0) / 0x100000000; }; \n  prng.double = function() {\n    do {\n      var top\n    = xg.next() >>> 11,\n        bot = (xg.next() >>> 0) / 0x100000000,\n        result = (top + bot) / (1 << 21);\n    } \n    while (result === 0);\n    return result;\n  }; \n  prng.int32 = xg.next(); \n  prng.quick = prng;\n  if (state) {\n    if \n    (typeof(state) === 'object') copy(state,\n    xg);\n    prng.state = function() { return copy(xg, {}); }; \n  } \n  return prng;\n}\n\nif (module && module.exports)\n{\n  module.exports = impl;\n} else if (define && define.amd) {\n  define(function() { return impl; });\n} else {\n  this.tychei = impl;\n}\n})(\n  this,\n  (typeof module) === 'object' && module, // present in node.js\n  (typeof \n  define) === 'function' && define // present with an AMD loader\n);\n\n"/*\nCopyright 2014 David\nBau.\n\nPermission is hereby granted, free of charge, to any person obtaining\na copy of this software and\nassociated documentation files (the\n"Software"), to deal in the Software without restriction, including\nwithout\nlimitation the rights to use, copy, modify, merge, publish,\ndistribute, sublicense, and/or sell copies of the Software,\nand to\npermit persons to whom the Software is furnished to do so, subject to\nthe following conditions:\n\nThe\nabove copyright notice and this permission notice shall be\nincluded in all copies or substantial\nportions of the Software.\n\nTHE SOFTWARE IS PROVIDED\n"AS IS", WITHOUT WARRANTY OF ANY\nKIND,\nEXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES\nOF\nMERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.\n\nIN NO\nEVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY\nCLAIM, DAMAGES\nOR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT,\nTORT OR OTHERWISE, ARISING\nFROM, OUT OF OR IN CONNECTION WITH THE\nSOFTWARE OR THE USE OR OTHER DEALINGS IN\nTHE SOFTWARE.\n\n*/\n\n(function (pool, math) {\n  // The following constants are related to IEEE 754\n  limits.\n  var global = this,\n      width = 256, // each RC4 output is 0 <= x < 256\n      chunks = 6, // at least\n        six RC4 outputs for each double\n      digits = 52, // there are 52 significant digits in a double\n      rngname =\n        'random', // rngname: name for Math.random and Math.seedrandom\n      startdenom = math.pow(width, chunks),\n      significance = math.pow(2, digits),\n      overflow\n    = significance * 2,\n      mask = width - 1,\n      nodecrypto; // node.js crypto module, initialized at the\n    bottom.\n  // seedrandom()\n  // This is the seedrandom function described above.\n  function seedrandom(seed,\n    options, callback) {\n    var key = [];\n    options = (options == true) ? { entropy: true } : (options || {});\n    // Flatten\n    the seed string or build one from local entropy if needed.\n    var shortseed = mixkey(flatten(\n      options.entropy ?\n      [seed, toString(pool)] : (\n        seed == null) ? autoseed() : seed, 3), key);\n    // Use the seed to initialize an ARC4\n    generator.\n    var arc4 = new ARC4(key);\n    // This function returns a random double in [0, 1) that contains\n    //\n    randomness in every bit of the mantissa of the IEEE 754 value.\n    var prng = function() {\n      var n = arc4.g(chunks),\n          // Start with a numerator n < 2 ^ 48\n          d = startdenom, // and denominator d = 2 ^ 48.\n          x =\n        0;\n      // and no\n      'extra last byte'.\n      while (n < significance) {\n        // Fill up all significant digits by\n        n = (n + x) * width;\n        // shifting numerator and\n        d *= width; // denominator and generating a\n        x = arc4.g(1);\n        // new least-significant-byte.\n      }\n      while (n >= overflow) {\n        // To avoid rounding up, before\n        adding\n        n /= 2; // last byte, shift everything\n        d /= 2; // right using integer\n        math until\n        x >>= 1; // we have exactly the desired bits.\n      }\n      return (n + x) / d; //\n    }\n    Form the number within [0, 1).\n  };\n  prng.int32 = function() { return arc4.g(4) | 0; }\n  prng.quick = function() {\n    return arc4.g(4) / 0x100000000; }\n  prng.double = prng;\n  // Mix the randomness into accumulated entropy.\n  mixkey(toString(arc4.S), pool);\n  // Calling convention: what to return as a\n  function of prng, seed, is_math.\n  return (options.pass || callback ||\n    function(prng, seed, is_math_call, state)\n    {\n      if (state) {\n        // Load the arc4 state from the given state if it has an S array.\n        if (state.S) {\n          copy(state, arc4); \n        } // Only provide the .state method if requested via options.state.\n        prng.state =\n        function() { return copy(arc4, {}); }; \n      } \n    } \n    // If called as a method of Math (Math.seedrandom()), mutate\n    //\n    Math.random because that is how seedrandom.js has worked since v1.0.\n    if (is_math_call) {\n      math[rngname] = prng; return seed; \n    } \n    // Otherwise, it is a newer calling convention, so return the\n    //

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prng directly.\n    else return prng;\n    })(\n prng,\n shortseed,\n 'global' in options ? options.global : (this ==
math),\n options.state);\n}\n\nmath['seed' + rngname] = seedrandom;\n\n\n// ARC4\n\n\n// An ARC4
implementation. The constructor takes a key in the
form of\n// an array of at most (width) integers that should be 0 <= x < (width).\n\n\n// The g(count) method returns
a pseudorandom integer that concatenates\n// the next (count) outputs from ARC4. Its return value is a number x\n//
that is in the range 0 <= x < (width ^ count).\n\n\nfunction ARC4(key) {\n var t, keylen = key.length,\n me =
this, i = 0, j = me.i = me.j = 0, s = me.S = [];\n\n // The empty key [] is treated as [0].\n if (!keylen) { key =
[keylen++]; }\n\n // Set up S using the standard key scheduling algorithm.\n while (i < width) {\n s[i] = i++; \n
}\n for (i = 0; i < width; i++) {\n s[i] = s[j = mask & (j + key[i % keylen]) + (t = s[i])];\n s[j] = t;\n }\n\n // The
'g' method returns the next (count) outputs as one number.\n (me.g = function(count) {\n // Using instance
members instead of closure state nearly doubles speed.\n var t, r = 0,\n i = me.i, j = me.j, s = me.S;\n while
(count--) {\n t = s[i = mask & (i + 1)];\n
r = r * width + s[mask & ((s[i] = s[j = mask & (j + t)]) + (s[j] = t))];\n }\n me.i = i; me.j = j;\n return r;\n
}\n\n // For robust unpredictability, the function call below automatically\n // discards an initial batch of values. This is
called RC4-drop[256].\n // See http://google.com/search?q=rsa+fluhrer+response&btnI\n })(width);\n\n\n\n\n//
copy()\n// Copies internal state of ARC4 to or from a plain object.\n\n\nfunction copy(f, t) {\n t.i = f.i;\n t.j = f.j;\n
t.S = f.S.slice();\n return t;\n};\n\n\n\n// flatten()\n// Converts an object tree to nested arrays of strings.\n\n\nfunction
flatten(obj, depth) {\n var result = [], typ = (typeof obj), prop;\n if (depth && typ == 'object') {\n for (prop in obj)
{\n try { result.push(flatten(obj[prop], depth - 1)); } catch (e) {} }\n }\n return (result.length ? result : typ ==
'string' ? obj + '\\0');\n}\n\n\n\n// mixkey()\n// Mixes a string seed into a key that is an array of integers, and\n//
returns a shortened string seed that is equivalent to the result key.\n\n\nfunction mixkey(seed, key) {\n var
stringseed = seed + "", smear, j = 0;\n while (j < stringseed.length) {\n key[mask & j] =\n mask & ((smear ^=
key[mask & j] * 19) + stringseed.charCodeAt(j++));\n }\n return toString(key);\n}\n\n\n\n// autoseed()\n// Returns
an object for autoseeding, using window.crypto and Node crypto\n// module if available.\n\n\nfunction autoseed()\n{\n try {\n var out;\n if (nodecrypto && (out = nodecrypto.randomBytes)) {\n // The use of 'out' to remember
randomBytes makes tight minified code.\n out = out(width);\n } else {\n out = new Uint8Array(width);\n
(global.crypto || global.msCrypto).getRandomValues(out);\n }\n return toString(out);\n } catch (e) {\n var
browser = global.navigator,\n plugins = browser && browser.plugins;\n return [+new Date, global, plugins,
global.screen, toString(pool)];\n }\n}\n\n\n\n// toString()\n//
Converts an array of charcodes to a string\n\n\nfunction toString(a) {\n return String.fromCharCode.apply(0,
a);\n}\n\n\n\n// When seedrandom.js is loaded, we immediately mix a few bits\n// from the built-in RNG into the
entropy pool. Because we do\n// not want to interfere with deterministic PRNG state later,\n// seedrandom will not
call math.random on its own again after\n// initialization.\n\n\nmixkey(math.random(), pool);\n\n\n\n// Nodejs and
AMD support: export the implementation as a module using\n// either convention.\n\n\nif ((typeof module) ==
'object' && module.exports) {\n module.exports = seedrandom;\n // When in node.js, try using crypto package for
autoseeding.\n try {\n nodecrypto = require('crypto');\n } catch (ex) {} } else if ((typeof define) == 'function'
&& define.amd) {\n define(function() { return seedrandom; });\n}\n\n\n// End anonymous scope, and pass initial
values.\n})(\n [], // pool: entropy pool starts empty\n Math // math: package containing
random, pow, and seedrandom\n);\n\n\n\n// A library of seedable RNGs implemented in Javascript.\n\n\n\n// Usage:\n\n\n// var seedrandom = require('seedrandom');\n\n\n// var random = seedrandom(1); // or any seed.\n\n\n// var x =
random(); // 0 <= x < 1. Every bit is random.\n\n\n// var x = random.quick(); // 0 <= x < 1. 32 bits of
randomness.\n\n\n// alea, a 53-bit multiply-with-carry generator by Johannes Baagøe.\n\n\n// Period: ~2^116\n\n\n// Reported
to pass all BigCrush tests.\n\n\nvar alea = require('./lib/alea');\n\n\n// xor128, a pure xor-shift generator by George
Marsaglia.\n\n\n// Period: 2^128-1.\n\n\n// Reported to fail: MatrixRank and LinearComp.\n\n\nvar xor128 =
require('./lib/xor128');\n\n\n// xorwow, George Marsaglia's 160-bit xor-shift combined plus weyl.\n\n\n// Period: 2^192-
2^32\n\n\n// Reported to fail: CollisionOver, SimpPoker, and LinearComp.\n\n\nvar xorwow = require('./lib/xorwow');\n\n\n//
xorshift7, by François Panneton and Pierre L'ecuyer, takes\n// a different approach: it adds robustness by allowing
more

```


shifts than Marsaglia's original three. It is a 7-shift generator with 256 bits, that passes BigCrush with no systematic failures. Period 2^{256-1} . No systematic BigCrush failures reported. `require('./lib/xorshift7');` xor4096, by Richard Brent, is a 4096-bit xor-shift with a very long period that also adds a Weyl generator. It also passes BigCrush with no systematic failures. Its long period may be useful if you have many generators and need to avoid collisions. Period: $2^{4128-2^{32}}$. No systematic BigCrush failures reported. `require('./lib/xor4096');` Tyche-i, by Samuel Neves and Filipe Araujo, is a bit-shifting random number generator derived from ChaCha, a modern stream cipher. <https://eden.dei.uc.pt/~sneves/pubs/2011-snfa2.pdf> Period: $\sim 2^{127}$. No systematic BigCrush failures reported. `require('./lib/tychei');` The original ARC4-based prng included in this library. Period: $\sim 2^{1600}$ `require('./seedrandom');` `nsr.alea = alea;` `nsr.xor128 = xor128;` `nsr.xorwow = xorwow;` `nsr.xorshift7 = xorshift7;` `nsr.xor4096 = xor4096;` `nsr.tychei = tychei;` `module.exports = sr;` `/** @license Copyright 2018 Google LLC. All Rights Reserved. Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License. */`

```

=====
*/
import * as seedrandom from 'seedrandom';
import {expectNumbersClose,
testEpsilon} from './test_util';
import {TypedArray} from './types';
export interface RandomBase {
nextValue(): number;
}
export interface RandomGamma {
nextValue(): number;
}
export interface
RandNormalDataTypes {
float32: Float32Array;
int32: Int32Array;
}
export interface
RandGammaDataTypes {
float32: Float32Array;
int32: Int32Array;
}
//
https://en.wikipedia.org/wiki/Marsaglia\_polar\_method
export class MPRandGauss implements RandomBase {
private mean: number;
private stdDev: number;
private nextVal: number;
private dtype?: keyof
RandNormalDataTypes;
private truncated?: boolean;
private upper?: number;
private lower?: number;
private random: seedrandom.prng;
constructor(
mean: number, stdDeviation: number, dtype?: keyof
RandNormalDataTypes,
truncated?: boolean, seed?: number) {
this.mean = mean;
this.stdDev =
stdDeviation;
this.dtype = dtype;
this.nextVal = NaN;
this.truncated
= truncated;
if (this.truncated) {
this.upper = this.mean + this.stdDev * 2;
this.lower = this.mean -
this.stdDev * 2;
}
const seedValue = seed ? seed : Math.random();
this.random =
seedrandom.alea(seedValue.toString());
}
/** Returns next sample from a Gaussian distribution. */
public
nextValue(): number {
if (!isNaN(this.nextVal)) {
const value = this.nextVal;
this.nextVal = NaN;
return value;
}
let resultX: number, resultY: number;
let isValid = false;
while (!isValid) {
let
v1: number, v2: number, s: number;
do {
v1 = 2 * this.random() - 1;
v2 = 2 * this.random() - 1;
s = v1 * v1 + v2 * v2;
} while (s >= 1 || s === 0);
const mul = Math.sqrt(-2.0 * Math.log(s) / s);
resultX = this.mean + this.stdDev * v1 * mul;
resultY = this.mean + this.stdDev * v2 * mul;
if
(!this.truncated || this.isValidTruncated(resultX))
{
isValid = true;
}
}
if (!this.truncated || this.isValidTruncated(resultY)) {
this.nextVal =
this.convertValue(resultY);
}
return this.convertValue(resultX);
}
/** Handles proper rounding for
non-floating-point numbers. */
private convertValue(value: number): number {
if (this.dtype == null ||
this.dtype === 'float32') {
return value;
}
return Math.round(value);
}
/** Returns true if less
than 2-standard-deviations from the mean. */
private isValidTruncated(value: number): boolean {
return value
<= this.upper && value >= this.lower;
}
}
// Marsaglia, George, and Wai Wan Tsang. 2000. "A Simple
Method for Generating
Gamma Variables."
export class RandGamma implements RandomGamma {
private
alpha: number;
private beta: number;
private d: number;
private c: number;
private dtype?: keyof
RandGammaDataTypes;
private randu: seedrandom.prng;
private randn:

```

```

MPRandGauss;\n\n constructor(\n  alpha: number, beta: number, dtype: keyof RandGammaDataTypes,\n  seed?: number) {\n  this.alpha = alpha;\n  this.beta = 1 / beta; // convert rate to scale parameter\n  this.dtype =\n  dtype;\n  const seedValue = seed ? seed : Math.random();\n  this.randu =\n  seedrandom.alea(seedValue.toString());\n  this.randn = new MPRandGauss(0, 1, dtype, false, this.randu());\n\n  if\n  (alpha < 1) {\n    this.d = alpha + (2 / 3);\n  } else {\n    this.d = alpha - (1 / 3);\n  }\n  this.c = 1 / Math.sqrt(9 *\n  this.d);\n  }\n\n  /** Returns next sample from a gamma distribution. */\n  public nextValue(): number {\n    let x2:\n    number, v0: number, v1: number, x: number, u: number, v: number;\n    while (true) {\n      do {\n        x =\n        this.randn.nextValue();\n        v = 1 + (this.c * x);\n      } while (v <= 0);\n      v *= v * v;\n      x2 = x * x;\n      v0 =\n      1 - (0.331 * x2 * x2);\n      v1 = (0.5 * x2) + (this.d * (1 - v + Math.log(v)));\n      u = this.randu();\n      if (u < v0 || Math.log(u) < v1) {\n        break;\n      }\n    }\n    v = (1 / this.beta) * this.d *\n    v;\n    if (this.alpha < 1) {\n      v *= Math.pow(this.randu(), 1 / this.alpha);\n    }\n    return this.convertValue(v);\n  }\n\n  /** Handles proper rounding for non-floating-point numbers. */\n  private convertValue(value: number):\n  number {\n    if (this.dtype === 'float32') {\n      return value;\n    }\n    return Math.round(value);\n  }\n}\n\nexport\n  class UniformRandom implements RandomBase {\n    private min: number;\n    private range: number;\n    private\n    random: seedrandom.prng;\n    private dtype?: keyof RandNormalDataTypes;\n\n    constructor(\n      min = 0, max =\n      1, dtype?: keyof RandNormalDataTypes,\n      seed?: string|number) {\n      this.min = min;\n      this.range = max -\n      min;\n      this.dtype = dtype;\n      if (seed == null) {\n        seed = Math.random();\n      }\n      if (typeof seed ===\n      'number') {\n        seed = seed.toString();\n      }\n      if (!this.canReturnFloat()\n      && this.range <= 1) {\n        throw new Error(`\n        The difference between ${min} - ${max} <= 1 and dtype is\n        not float`);\n      }\n      this.random = seedrandom.alea(seed);\n    }\n\n    /** Handles proper rounding for non floating\n    point numbers. */\n    private canReturnFloat = () =>\n    (this.dtype == null || this.dtype === 'float32');\n\n    private\n    convertValue(value: number): number {\n      if (this.canReturnFloat()) {\n        return value;\n      }\n      return\n      Math.round(value);\n    }\n\n    nextValue() {\n      return this.convertValue(this.min + this.range * this.random());\n    }\n  }\n\n  export function jarqueBeraNormalityTest(values: TypedArray|number[]) {\n    //\n    https://en.wikipedia.org/wiki/Jarque%E2%80%93Bera_test\n    const n = values.length;\n    const s =\n    skewness(values);\n    const k = kurtosis(values);\n    const jb = n / 6 * (Math.pow(s, 2) + 0.25 * Math.pow(k - 3, 2));\n\n    // JB test requires 2-degrees of freedom from Chi-Square @ 0.95;\n\n    //\n    http://www.itl.nist.gov/div898/handbook/eda/section3/eda3674.htm\n\n    const CHI_SQUARE_2DEG = 5.991;\n    if (jb > CHI_SQUARE_2DEG) {\n      throw new Error(`Invalid p-value\n      for JB: ${jb}`);\n    }\n  }\n\n  export function expectArrayInMeanStdRange(\n    actual: TypedArray|number[],\n    expectedMean: number, expectedStdDev: number,\n    epsilon?: number) {\n    if (epsilon == null) {\n      epsilon =\n      testEpsilon();\n    }\n    const actualMean = mean(actual);\n    expectNumbersClose(actualMean, expectedMean,\n    epsilon);\n    expectNumbersClose(\n      standardDeviation(actual, actualMean), expectedStdDev,\n      epsilon);\n  }\n\n  function mean(values: TypedArray|number[]) {\n    let sum = 0;\n    for (let i = 0; i < values.length;\n    i++) {\n      sum += values[i];\n    }\n    return sum / values.length;\n  }\n\n  function standardDeviation(values:\n  TypedArray|number[], mean: number) {\n    let squareDiffSum = 0;\n    for (let i = 0; i < values.length; i++) {\n      const\n      diff = values[i] - mean;\n      squareDiffSum += diff * diff;\n    }\n    return Math.sqrt(squareDiffSum\n    / values.length);\n  }\n\n  function kurtosis(values: TypedArray|number[]) {\n    //\n    https://en.wikipedia.org/wiki/Kurtosis\n    const valuesMean = mean(values);\n    const n = values.length;\n    let sum2 =\n    0;\n    let sum4 = 0;\n    for (let i = 0; i < n; i++) {\n      const v = values[i] - valuesMean;\n      sum2 += Math.pow(v,\n      2);\n      sum4 += Math.pow(v, 4);\n    }\n    return (1 / n) * sum4 / Math.pow((1 / n) * sum2, 2);\n  }\n\n  function\n    skewness(values: TypedArray|number[]) {\n      // https://en.wikipedia.org/wiki/Skewness\n      const valuesMean =\n      mean(values);\n      const n = values.length;\n      let sum2 = 0;\n      let sum3 = 0;\n      for (let i = 0; i < n; i++) {\n        const v =\n        values[i] - valuesMean;\n        sum2 += Math.pow(v, 2);\n        sum3 += Math.pow(v, 3);\n      }\n      return (1 / n) * sum3 /\n      Math.pow((1 / (n - 1)) * sum2, 3 / 2);\n    }\n  }\n\n  /**\n  * @license\n  * Copyright 2020 Google LLC. All Rights\n  Reserved.\n  * Licensed under the Apache License, Version 2.0 (the "License");\n  * you may not use this file\n  except in compliance

```

with the License.\n * You may obtain a copy of the License at\n * <http://www.apache.org/licenses/LICENSE-2.0>\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {Tensor} from './tensor';\nimport {Rank, ShapeMap} from './types';\nimport {buffer} from './buffer';\nimport {op} from './operation';\nimport {RandGamma} from './rand_util';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a gamma distribution.\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param alpha The shape parameter of the gamma distribution.\n * @param beta The inverse scale parameter of the gamma distribution. Defaults to 1.\n * @param dtype The data type of the output. Defaults to float32.\n * @param seed The seed for the random number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction randomGamma<R>(shape: ShapeMap[R], alpha: number, beta = 1, dtype: 'float32'|'int32' = 'float32', seed?: number): Tensor<R> {\n  if (beta == null) {\n    beta = 1;\n  }\n  if (dtype == null) {\n    dtype = 'float32';\n  }\n  if (dtype !== 'float32' && dtype !== 'int32') {\n    throw new Error(`Unsupported data type ${dtype}`);\n  }\n  const rgamma = new RandGamma(alpha, beta, dtype, seed);\n  const res = buffer(shape, dtype);\n  for (let i = 0; i < res.values.length; i++) {\n    res.values[i] = rgamma.nextValue();\n  }\n  return res.toTensor();\n}\n\nexport const randomGamma = op({randomGamma_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {buffer} from './buffer';\nimport {op} from './operation';\nimport {MPRandGauss} from './rand_util';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a normal distribution.\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param mean The mean of the normal distribution.\n * @param stdDev The standard deviation of the normal distribution.\n * @param dtype The data type of the output.\n * @param seed The seed for the random number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction randomNormal<R>(shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32', seed?: number): Tensor<R> {\n  if (dtype != null && (dtype as DataType) === 'bool') {\n    throw new Error(`Unsupported data type ${dtype}`);\n  }\n  const randGauss = new MPRandGauss(mean, stdDev, dtype, false /* truncated */, seed);\n  const res = buffer(shape, dtype);\n  for (let i = 0; i < res.values.length; i++) {\n    res.values[i] = randGauss.nextValue();\n  }\n  return res.toTensor();\n}\n\nexport const randomNormal = op({randomNormal_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```

*\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {buffer}
from './buffer';\nimport {op} from './operation';\nimport {UniformRandom} from './rand_util';\n\n/**\n * Creates a
`tf.Tensor` with values sampled from a uniform distribution.\n *\n * The generated values follow a uniform
distribution in
the range [minval,\n * maxval). The lower bound minval is included in the range, while the upper\n * bound maxval
is excluded.\n *\n * ```js\n * tf.randomUniform([2, 2]).print();\n * ```\n *\n * @param shape An array of integers
defining the output tensor shape.\n * @param minval The lower bound on the range of random values to generate.\n
* Defaults to 0.\n * @param maxval The upper bound on the range of random values to generate.\n * Defaults to
1.\n * @param dtype The data type of the output tensor. Defaults to 'float32'.\n *\n * @doc {heading: 'Tensors',
subheading: 'Random'}\n */\nfunction randomUniform<R extends Rank>(\n  shape: ShapeMap[R], minval = 0,\n  maxval = 1, dtype: DataType = 'float32',\n  seed?: number|string): Tensor<R> {\n  const res = buffer(shape,\n  dtype);\n  const random = new UniformRandom(minval, maxval, null, seed);\n  for (let i = 0; i < res.values.length;\n  i++) {\n    res.values[i] = random.nextValue();\n  }\n  return res.toTensor();\n}\n\nexport const
randomUniform = op({randomUniform_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {Range, RangeAttrs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor1D} from './tensor';\n\n/**\n * Creates a new
`tf.Tensor1D` filled with the numbers
in the range provided.\n *\n * The tensor is a is half-open interval meaning it includes start, but\n * excludes stop.
Decrementing ranges and negative step values are also\n * supported.\n *\n * ```js\n * tf.range(0, 9,\n 2).print();\n * ```\n *\n * @param start An integer start value\n * @param stop An integer stop value\n * @param
step An integer increment (will default to 1 or -1)\n * @param dtype The data type of the output tensor. Defaults to
'float32'.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function range(\n  start: number,\n  stop: number, step = 1,\n  dtype: 'float32'|'int32' = 'float32'): Tensor1D {\n  if (step === 0) {\n    throw new
Error('Cannot have a step of zero');\n  }\n  const attrs: RangeAttrs = {start, stop, step, dtype};\n  return
ENGINE.runKernel(Range, {} /* inputs */, attrs as {} as NamedAttrMap);\n}\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {Real, RealInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns the
real part of a complex (or real) tensor.\n *\n * Given a tensor input, this
operation returns a tensor of type float that is\n * the real part of each element in input considered as a complex
number.\n *\n * If the input is real, it simply makes a clone.\n *\n * ```js\n * const x = tf.complex([-2.25, 3.25],\n  [4.75, 5.75]);\n * tf.real(x).print();\n * ```\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction
real<T extends Tensor>(input: T|TensorLike): T {\n  const $input = convertToTensor(input, 'input', 'real');\n  const inputs: RealInputs = {input: $input};\n  return ENGINE.runKernel(Real, inputs as {} as

```



```

T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'relu6');\n\n  const inputs: Relu6Inputs = {x: $x};\n\n  return ENGINE.runKernel(Relu6, inputs as { } as NamedTensorMap);\n}\n\nexport const relu6 =
op({relu6_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Reverse, ReverseAttrs, ReverseInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Reverses a `tf.Tensor` along a specified
axis.\n *\n * Also available are stricter rank-specific methods that assert that `x` is\n * of the given rank:\n * -
`tf.reverse1d`\n * - `tf.reverse2d`\n * - `tf.reverse3d`\n * - `tf.reverse4d`\n *\n * Except `tf.reverse1d` (which
does not have axis param), all methods have\n * same signature as this method.\n *\n * ```js\n * const x =
tf.tensor1d([1, 2, 3, 4]);\n *\n * x.reverse().print();\n *\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n * x.reverse(axis).print();\n *\n * ```\n *\n * @param x The input tensor to be reversed.\n * @param axis The set of dimensions to reverse. Must be in
the\n * range [-rank(x), rank(x)]. Defaults to all axes.\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and
Joining'}\n *\nfunction reverse_<T extends Tensor>(\n  x: T|TensorLike, axis?: number|number[]): T {\n  const $x
= convertToTensor(x, 'x', 'reverse');\n\n  const inputs: ReverseInputs = {x: $x};\n  const attrs: ReverseAttrs = {dims:
axis};\n\n  return ENGINE.runKernel(\n    Reverse, inputs as { } as NamedTensorMap, attrs as { } as
NamedAttrMap);\n}\n\nexport const reverse = op({reverse_});\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Tensor1D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from
'./reverse';\n\n/**\n * Reverses a `tf.Tensor1D`.\n *\n * @param x The input tensor.\n *\nfunction reverse1d_(x:
Tensor1D|TensorLike): Tensor1D {\n  const $x = convertToTensor(x, 'x', 'reverse');\n  util.assert(\n    $x.rank ===
1,\n    () => `Error in reverse1D: x must be rank 1 but got rank
${$x.rank}.`);\n  return reverse($x, 0);\n}\n\nexport const reverse1d = op({reverse1d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from

```

```

./operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor2D` along a specified axis.\n *\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n *   range [-rank(x), rank(x)]. Defaults to all axes.\n */\nfunction reverse2d(x: Tensor2D|TensorLike, axis?: number|number[]):\nTensor2D {\n  const $x = convertToTensor(x, 'x', 'reverse');\n  util.assert(\n    $x.rank === 2,\n    () => `Error in\nreverse2D: x must be rank 2 but got rank ${$x.rank}.`);\n  return reverse($x, axis);\n}\n\nexport const reverse2d =\nop({reverse2d_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\nthe Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed\nunder the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF\nANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====\n
*\n\nimport {Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from\n './reverse';\n\n/**\n * Reverses a `tf.Tensor3D` along a specified axis.\n *\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n *   range [-rank(x), rank(x)]. Defaults to all axes.\n */\nfunction reverse3d(x: Tensor3D|TensorLike, axis?: number|number[]): Tensor3D {\n  const $x =\nconvertToTensor(x, 'x', 'reverse');\n  util.assert(\n    $x.rank === 3,\n    () => `Error in reverse3D: x must be rank\n3 but got rank ${$x.rank}.`);\n  return reverse($x, axis);\n}\n\nexport const reverse3d = op({reverse3d_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */

```

```

=====\n
*\n\nimport {Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport\n{op} from './operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor4D` along a specified\naxis.\n *\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n *   range [-rank(x), rank(x)]. Defaults to all axes.\n */\nfunction reverse4d(x: Tensor4D|TensorLike, axis?:\nnumber|number[]): Tensor4D {\n  const $x = convertToTensor(x, 'x', 'reverse');\n  util.assert(\n    $x.rank === 4,\n    () => `Error in reverse4D: x must be rank 4 but got rank ${$x.rank}.`);\n  return reverse($x, axis);\n}\n\nexport\nconst reverse4d = op({reverse4d_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\ncompliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR\nCONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\npermissions and\n * limitations under the License.\n */

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Round, RoundInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes\nround of input `tf.Tensor` element-wise: `round(x)`.\n * It implements banker's rounding.\n *\n * ``js\n * const x =\ntf.tensor1d([.6, 1.1, -3.3]);\n *\n * x.round().print(); // or tf.round(x)\n *\n * ``\n * @param x The input tensor.\n */

```

```

@doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction round_<T extends Tensor>(x:
T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'round');\n  const inputs: RoundInputs = {x: $x};\n\n  return ENGINE.runKernel(Round, inputs as {} as NamedTensorMap);\n}\n\nexport const round =
op({round_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Rsqrt, RsqrtInputs}
from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes reciprocal of square root of the input `tf.Tensor`
element-wise:\n * `y = 1 / sqrt(x)`\n *\n * ``js\n * const x = tf.tensor1d([1, 2, 4, -1]);\n *\n * x.rsqrt().print(); // or
tf.rsqrt(x)\n * ``\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
*\nfunction rsqrt_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'rsqrt');\n\n  const
inputs: RsqrtInputs = {x: $x};\n\n  return ENGINE.runKernel(Rsqrt, inputs as {} as NamedTensorMap);\n}\n\nexport
const rsqrt = op({rsqrt_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n\nimport {Scalar} from './tensor';\nimport {DataType} from './types';\nimport {isArray} from
'./util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-0 `tf.Tensor` (scalar) with the
provided value and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we
recommend using `tf.scalar` as it makes the code more readable.\n *\n * ``js\n * tf.scalar(3.14).print();\n * ``\n *\n * @param value
The value of the scalar.\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading:
'Creation'}\n *\nfunction scalar(\n  value: number|boolean|string|Uint8Array, dtype?: DataType): Scalar {\n
  if (((isArray(value) && dtype !== 'string') || Array.isArray(value)) && dtype !== 'complex64') {\n
    throw new Error(\n      'Error creating a new Scalar: value must be a primitive ' +\n
      '(number|boolean|string)');\n  }\n  if (dtype === 'string' && isArray(value) && !(value instanceof
Uint8Array)) {\n    throw new Error(\n      'When making a scalar from encoded string, ' +\n
      'the value must be `Uint8Array`.');\n  }\n  const shape: number[] = [];\n  const inferredShape: number[] = [];\n  return
makeTensor(value, shape, inferredShape, dtype) as Scalar;\n}\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====

```



```

*\n\nimport {ENGINE} from './engine';\nimport {Selu, SeluInputs} from './kernel_names';\nimport {Tensor} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n**\n * Computes
 scaled exponential linear element-wise.\n *\n * `x < 0 ? scale * alpha * (exp(x) - 1) : x`\n *\n * ``js\n * const x =
 tf.tensor1d([-1,
 2, -3, 4]);\n *\n * x.selu().print(); // or tf.selu(x)\n * ``\n * @param x The input tensor.\n *\n * @doc {heading:
 'Operations', subheading: 'Basic math'}\n *\nfunction selu_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
 convertToTensor(x, 'x', 'selu');\n\n  const inputs: SeluInputs = {x: $x};\n\n  return ENGINE.runKernel(Selu, inputs
 as {} as NamedTensorMap);\n}\n\nexport const selu = op({selu_});\n", "**\n * @license\n * Copyright 2020
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
=====*\n
*\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\nimport * as util from './util';\nimport {conv2d} from './conv2d';\nimport
 {depthwiseConv2d} from './depthwise_conv2d';\nimport {op} from './operation';\nimport {reshape} from
 './reshape';\n\n**\n * 2-D convolution with separable filters.\n *\n * Performs a depthwise convolution that acts
 separately on channels followed\n * by a pointwise convolution that mixes channels. Note that this is\n *
 separability between dimensions [1, 2] and 3, not spatial separability\n * between dimensions 1 and 2.\n *\n * See\n *
 [https://www.tensorflow.org/api_docs/python/tf/nn/separable_conv2d](\n *
 https://www.tensorflow.org/api_docs/python/tf/nn/separable_conv2d)\n * for more details.\n *\n * @param x The
 input
 tensor, of rank 4 or rank 3, of shape\n *   `[batch, height, width, inChannels]`. If rank 3, batch of 1 is\n *
 assumed.\n * @param depthwiseFilter The depthwise filter tensor, rank 4, of shape\n *   `[filterHeight, filterWidth,
 inChannels, channelMultiplier]`. This is\n *   the filter used in the first step.\n * @param pointwiseFilter The
 pointwise filter tensor, rank 4, of shape\n *   `[1, 1, inChannels * channelMultiplier, outChannels]`. This is\n *
 the filter used in the second step.\n * @param strides The strides of the convolution: `[strideHeight,\n *
 strideWidth]`. If strides is a single number, then `strideHeight ==\n * strideWidth`. \n * @param pad The type of
 padding algorithm.\n * - `same` and stride 1: output will be of same size as input,\n *   regardless of filter size.\n *
 - `valid`: output will be smaller than input if filter is larger\n *   than 1x1.\n * - For more info, see this
 guide:\n *   [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
 https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dilations The dilation rates:
 `[dilationHeight, dilationWidth]`\n *   in which we sample input values across the height and width dimensions\n *
 in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single\n *   number, then `dilationHeight ==
 dilationWidth`. If it is greater than\n *   1, then all values of `strides` must be 1.\n * @param dataType: An
 optional string from: "NHWC", "NCHW". Defaults to\n *   "NHWC". Specify the data format of the input and
 output data. With the\n *   default format "NHWC", the data is stored in the order of: [batch,\n *   height, width,
 channels]. Only "NHWC" is currently supported.\n *\n * @doc {heading: 'Operations', subheading:
 'Convolution'}\n *\nfunction separableConv2d_<T extends Tensor3D|Tensor4D>(\n  x: T|TensorLike,
 depthwiseFilter: Tensor4D|TensorLike,\n  pointwiseFilter: Tensor4D|TensorLike, strides: [number,
 number]|number,\n  pad: 'valid'|'same', dilation: [number, number]|number = [1, 1],\n  dataType:
 'NHWC'|'NCHW' = 'NHWC'): T {\n  const $x = convertToTensor(x, 'x', 'separableConv2d');\n  const
 $depthwiseFilter =\n    convertToTensor(depthwiseFilter, 'depthwiseFilter', 'separableConv2d');\n  const
 $pointwiseFilter =\n    convertToTensor(pointwiseFilter, 'pointwiseFilter', 'separableConv2d');\n  let x4D = $x as
 Tensor4D;\n  let reshapedTo4D = false;\n  if ($x.rank === 3) {\n    reshapedTo4D = true;\n    x4D = reshape($x, [1,

```

```
$x.shape[0], $x.shape[1], $x.shape[2]);\n }\n\n if (dataFormat === 'NCHW') {\n   throw new Error(\n     'separableConv2d currently does not support dataFormat NCHW; only ' +\n     'NHWC is supported');\n }\n\n util.assert(\n   x4D.rank === 4,\n   () => `Error in separableConv2d: input must be rank 4, but got ` +\n   `rank ${x4D.rank}.`);\n util.assert(\n   $depthwiseFilter.rank === 4,\n   () => `Error in separableConv2d:\n depthwise\n filter must be rank 4, but ` +\n   `got rank ${$depthwiseFilter.rank}.`);\n util.assert(\n   $pointwiseFilter.rank\n === 4,\n   () => `Error in separableConv2d: pointwise filter must be rank 4, but ` +\n   `got rank\n ${$depthwiseFilter.rank}.`);\n util.assert(\n   $pointwiseFilter.shape[0] === 1,\n   () =>`\n   `Error in\n separableConv2d: the first dimension of pointwise filter ` +\n   `must be 1, but got\n ${$pointwiseFilter.shape[0]}.`);\n util.assert(\n   $pointwiseFilter.shape[1] === 1,\n   () => `Error in\n separableConv2d: the second dimension of pointwise ` +\n   `filter must be 1, but got\n ${$pointwiseFilter.shape[1]}.`);\n\n const inChannels = $depthwiseFilter.shape[2];\n const channelMultiplier =\n $depthwiseFilter.shape[3];\n util.assert(\n   $pointwiseFilter.shape[2] === inChannels * channelMultiplier,\n   ()\n =>`\n   `Error in separableConv2d: the third dimension of pointwise filter ` +\n   `must be\n ${inChannels * channelMultiplier}, ` +\n   `but got ${$pointwiseFilter.shape[2]}.`);\n\n const depthwise =\n depthwiseConv2d(\n   x4D, $depthwiseFilter, strides, pad, dataFormat, dilation);\n const pointwiseStride = 1;\n const res =\n conv2d(depthwise, $pointwiseFilter, pointwiseStride, 'valid', dataFormat);\n\n if (reshapedTo4D)\n {\n   return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n return res as T;\n }\n\nexport const\n separableConv2d = op({separableConv2d_});\n\n",/**\n * @license\n * Copyright 2020 Google Inc. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS\n OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions\n and\n * limitations under the License.\n *\n =====\n\n *\nimport {Tensor, TensorBuffer} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n {TensorLike} from './types';\nimport * as util from './util';\n\n**\n * Computes the difference between two lists of\n numbers.\n * Given a Tensor `x` and a Tensor `y`, this operation returns a Tensor `out`\n * that represents all\n values that are in `x` but not in `y`. The returned\n * Tensor `out` is sorted in the same order that the numbers appear\n in `x`\n * (duplicates are preserved). This operation also returns a Tensor indices that\n * represents the position of\n each out element in `x`. In other words:\n * `out[i] = x[idx[i]]` for i in [0, 1, ..., out.length - 1]\n * ```\n * const x = [1, 2, 3, 4, 5, 6];\n * const y = [1, 3,\n 5];\n * const [out, indices] = await tf.setdiff1dAsync(x, y);\n * out.print(); // [2, 4, 6]\n * indices.print(); // [1, 3,\n 5]\n * ```\n * @param x 1-D Tensor. Values to keep.\n * @param y 1-D Tensor. Must have the same type as x.\n Values to exclude in the\n * output.\n * @returns Promise of Tensor tuple [out, indices].\n * out: Tensor with the\n same type as x.\n * indices: A Tensor of type int32.\n * @doc {heading: 'Tensors', subheading:\n 'Transformations'}\n\n * Async function setdiff1dAsync(\n   x: Tensor|TensorLike, y: Tensor|TensorLike):\n Promise<[Tensor, Tensor]> {\n   const $x = convertToTensor(x, 'x', 'setdiff1d');\n   const $y = convertToTensor(y, 'y',\n 'setdiff1d');\n\n   util.assert(\n     $x.dtype === $y.dtype,\n     () => `x and y should have the same dtype, but got x\n (${\n     $x.dtype}) and y (${ $y.dtype}).`);\n\n   util.assert(\n     $x.rank === 1, () => `x should be 1D tensor, but\n got x (${ $x.shape}).`);\n\n   util.assert(\n     $y.rank === 1, () =>\n     `y should be 1D tensor, but got y (${ $y.shape}).`);\n\n   const xVals = await $x.data();\n   const yVals = await\n $y.data();\n   const ySet = new Set(yVals);\n\n   let outputSize = 0;\n   for (let i = 0; i < xVals.length; i++) {\n     if\n (!ySet.has(xVals[i])) {\n       outputSize++;\n     }\n   }\n\n   const buffer = new TensorBuffer([outputSize],\n $x.dtype);\n   const indices = new TensorBuffer([outputSize], 'int32');\n   for (let i = 0, p = 0; i < xVals.length; i++)\n {\n     if (!ySet.has(xVals[i])) {\n       buffer.values[p] = xVals[i];\n       indices.values[p] = i;\n       p++;\n     }\n   }\n }
```

return [buffer.toTensor(), indices.toTensor()];\n}\nexport const setdiff1dAsync = setdiff1dAsync_;\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *

Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*/\n\nimport {ENGINE} from './engine';\nimport {Sign, SignInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns an element-wise indication of the sign of a number.\n *\n * @param x The input Tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction
```

```
  sign_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'sign');\n  const inputs: SignInputs = {x: $x};\n  return ENGINE.runKernel(Sign, inputs as { } as NamedTensorMap);\n}\n\nexport const sign = op({sign_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*/\n\nimport {ENGINE} from './engine';\nimport {Sin, SinInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes sin of the input Tensor element-wise: `sin(x)`\n *\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction sin_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'sin');\n  const inputs: SinInputs = {x: $x};\n  return ENGINE.runKernel(Sin, inputs as { } as NamedTensorMap);\n}\n\nexport const sin = op({sin_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*/\n\nimport {ENGINE} from './engine';\nimport {Sinh, SinhInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes hyperbolic sin of the input `tf.Tensor` element-wise: `sinh(x)`\n *\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction sinh_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'sinh');\n  const inputs:
```

```
SinhInputs = {x: $x};\n\n return ENGINE.runKernel(Sinh, inputs as { } as NamedTensorMap);\n\n}\n\nexport const\nsinh = op({sinh_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n
```

```
* =====\n*\n*\nimport {Tensor1D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {slice} from\n './slice';\n\n/**\n * Extracts a 1D slice from 1D array starting at coordinates `begin` and is\n * of length `size`. See\n `slice` for details.\n *\nfunction slice1d_(\n  x: Tensor1D|TensorLike, begin: number, size: number): Tensor1D {\n  const $x = convertToTensor(x, 'x', 'slice1d');\n  util.assert(\n    $x.rank === 1,\n    () =>\n      `slice1d expects a\n rank-1 tensor, but got a rank-${$x.rank} tensor`);\n  return slice($x, [begin], [size]);\n}\n\nexport const slice1d =\nop({slice1d_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance\n with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-\n 2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *\n
```

```
=====\n*\n*\nimport {Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {slice} from\n './slice';\n\n/**\n * Extracts a 2D slice from a 2D array starting at coordinates `begin` and\n * is of size `size`. See\n `slice` for details.\n *\nfunction slice2d_(\n  x: Tensor2D|TensorLike, begin: [number, number],\n  size: [number,\n number]):\n  Tensor2D {\n  const $x = convertToTensor(x, 'x', 'slice2d');\n  util.assert(\n    $x.rank === 2,\n    () =>\n      `slice2d expects a rank-2\n tensor, but got a rank-${$x.rank} tensor`);\n  return slice($x, begin, size);\n}\n\nexport const slice2d = op({slice2d_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *\n
```

```
=====\n*\n*\nimport\n{Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from\n './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {slice} from\n './slice';\n\n/**\n * Extracts a 3D slice from a 3D array starting at coordinates `begin` and\n * is of size `size`. See\n `slice` for details.\n *\nfunction slice3d_(\n  x: Tensor3D|TensorLike, begin: [number, number, number],\n  size: [number, number,\n number]): Tensor3D {\n  const $x = convertToTensor(x, 'x', 'slice3d');\n  util.assert(\n    $x.rank === 3,\n    ()\n =>\n      `slice3d expects a rank-3\n tensor, but got a rank-${$x.rank} tensor`);\n  return slice($x, begin,\n size);\n}\n\nexport const slice3d = op({slice3d_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of
```

the License at <http://www.apache.org/licenses/LICENSE-2.0> Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
*\n\nimport {Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from './slice';\n\n/**\n * Extracts a 4D slice from a 4D array starting at coordinates `begin` and is of size `size`. See `slice` for details.\n *\nfunction slice4d_(\n  x: Tensor4D|TensorLike, begin: [number, number, number, number],\n  size: [number, number, number, number]): Tensor4D {\n  const $x = convertToTensor(x, 'x', 'slice4d');\n  util.assert($x.rank === 4, () => `slice4d expects a rank-4 tensor, but got a rank-${$x.rank} tensor`);\n  return slice($x, begin, size);\n}\n\nexport const slice4d = op({slice4d_});\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
```

```
*\n\nimport {ENGINE} from './engine';\nimport {Softmax, SoftmaxAttrs, SoftmaxInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes the softmax normalized vector given the logits.\n *\n * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n * a.softmax().print(); // or tf.softmax(a)\n * ```\n *\n * ```js\n * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);\n * a.softmax().print(); // or tf.softmax(a)\n * ```\n *\n * @param logits The logits array.\n * @param dim The dimension softmax would be performed on. Defaults to -1\n * which indicates the last dimension.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n *\nfunction softmax_<T extends Tensor>(logits: T|TensorLike, dim = -1): T {\n  const $logits = convertToTensor(logits, 'logits', 'softmax', 'float32');\n  if (dim === -1) {\n    dim = $logits.rank - 1;\n  }\n  if (dim !== $logits.rank - 1) {\n    throw Error(`Softmax along a non-last dimension is not yet supported. ` +\n      `Logits was rank ${$logits.rank} and dim was ${dim}`);\n  }\n  const inputs: SoftmaxInputs = {logits: $logits};\n  const attrs: SoftmaxAttrs = {dim};\n  return ENGINE.runKernel(Softmax, inputs as {}, as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const softmax = op({softmax_});\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
```

```
*\n\nimport {ENGINE} from './engine';\nimport {FFT, FFTInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {assert} from './util';\nimport {op} from './operation';\n\n/**\n * Fast Fourier transform.\n *\n * Computes the 1-dimensional discrete Fourier transform over the inner-most dimension of input.\n *\n * ```js\n * const real = tf.tensor1d([1, 2, 3]);\n * const imag = tf.tensor1d([1, 2, 3]);\n * const x = tf.complex(real, imag);\n * x.fft().print(); // tf.spectral.fft(x).print();\n *\n=====
```

```

* ```\n * @param input The complex input to compute an fft over.\n *\n * @doc {heading: 'Operations', subheading:
'Spectral', namespace: 'spectral'}\n *\nfunction
fft_(input: Tensor): Tensor {\n  assert(\n    input.dtype === 'complex64',\n    () => `The dtype for tf.spectral.fft()
must be complex64` +\n    `but got ${input.dtype}.`);\n\n  const inputs: FFTInputs = {input};\n\n  return
ENGINE.runKernel(FFT, inputs as {} as NamedTensorMap);\n}\n\nexport const fft = op({fft_});\n", /**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {IFFT, IFFTInputs} from '../kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {assert} from
'../util';\nimport {op} from './operation';\n\n/**\n * Inverse fast Fourier transform.\n *\n * Computes the inverse 1-
dimensional discrete Fourier transform over the\n * inner-most dimension of input.\n *\n * ```\n * const real =
tf.tensor1d([1, 2, 3]);\n * const imag = tf.tensor1d([1, 2, 3]);\n * const x = tf.complex(real, imag);\n *\n *
x.ifft().print(); // tf.spectral.ifft(x).print();\n * ```\n * @param input The complex input to compute an ifft over.\n *\n *
@doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n *\nfunction ifft_(input: Tensor):
Tensor {\n  assert(\n    input.dtype === 'complex64',\n    () => `The dtype for tf.spectral.ifft() must be complex64`
+\n    `but got
${input.dtype}.`);\n\n  const inputs: IFFTInputs = {input};\n\n  return ENGINE.runKernel(IFFT, inputs as {} as
NamedTensorMap);\n}\n\nexport const ifft = op({ifft_});\n", /**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor, Tensor2D} from '../tensor';\nimport {complex} from './complex';\nimport {concat} from
'./concat';\nimport {imag} from './imag';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport
{real} from './real';\nimport {reshape} from './reshape';\nimport {reverse} from './reverse';\nimport {scalar} from
'./scalar';\nimport {slice} from './slice';\n\nimport {ifft} from './ifft';\n\n/**\n * Inversed real value input fast
Fourier transform.\n *\n * Computes the 1-dimensional inversed discrete Fourier transform over the\n * inner-most
dimension of the real input.\n *\n * ```\n * const real = tf.tensor1d([1, 2, 3]);\n * const imag = tf.tensor1d([0, 0,
0]);\n * const x = tf.complex(real, imag);\n *\n * x.irfft().print();\n * ```\n * @param input The real value input to
compute an irfft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n *\nfunction irfft_(input: Tensor): Tensor {\n  const innerDimensionSize = input.shape[input.shape.length - 1];\n  const batch = input.size / innerDimensionSize;\n  let ret: Tensor;\n\n  if (innerDimensionSize <= 2) {\n    const complexInput = reshape(input, [batch, innerDimensionSize]);\n    ret =
ifft(complexInput);\n  } else {\n    // The length of unique components of the DFT of a real-valued signal\n    // is 2 *
(input_len - 1)\n    const outputShape = [batch, 2 * (innerDimensionSize - 1)];\n    const realInput =
reshape(real(input), [batch, innerDimensionSize]);\n    const imagInput = reshape(imag(input), [batch,
innerDimensionSize]);\n\n    const realConjugate =\n      reverse(slice(realInput, [0, 1], [batch, innerDimensionSize
- 2]), 1);\n    const imagConjugate: Tensor2D = mul(\n      reverse(slice(imagInput, [0, 1], [batch,
innerDimensionSize - 2]), 1),\n      scalar(-1));\n\n    const r = concat([realInput, realConjugate], 1);\n    const i =
concat([imagInput, imagConjugate], 1);\n    const complexInput =\n      reshape(complex(r, i), [outputShape[0],

```

```

outputShape[1]);\n ret = ifft(complexInput);\n }\n ret = real(ret);\n // reshape the result
if the input is 3D tensor.\n if (input.rank === 3 && input.shape[0] !== 0) {\n  const temp = ret;\n  const batch =
input.shape[0];\n  ret = reshape(ret, [batch, ret.shape[0] / batch, ret.shape[1]]);\n  temp.dispose();\n }\n return
ret;\n}\n\nexport const irfft = op({irfft_});\n","/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {ENGINE} from './engine';\nimport {SplitV, SplitVAttrs, SplitVInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\n\nimport {op} from './operation';\n\n/**\n * Splits a `tf.Tensor` into sub tensors.\n *\n * If
`numOrSizeSplits` is a number, splits `x` along dimension `axis` into `numOrSizeSplits` smaller tensors.\n *
Requires that `numOrSizeSplits` evenly divides `x.shape[axis]`.\n *\n * If `numOrSizeSplits` is a number array,
splits `x` into\n * `numOrSizeSplits.length` pieces. The shape of the `i`-th piece has the\n * same size as `x` except
along dimension `axis` where the size is\n * `numOrSizeSplits[i]`.\n *\n * ````js\n * const x = tf.tensor2d([1, 2, 3, 4,
5, 6, 7, 8], [2, 4]);\n * const [a, b] = tf.split(x, 2, 1);\n * a.print();\n * b.print();\n *\n * const [c, d, e] =
tf.split(x, [1, 2, 1], 1);\n * c.print();\n * d.print();\n * e.print();\n * ````\n *\n * @param x The input
tensor to split.\n * @param numOrSizeSplits Either an integer indicating the number of\n * splits along the axis or
an array of integers containing the sizes of\n * each output tensor along the axis. If a number then it must evenly
divide\n * `x.shape[axis]`; otherwise the sum of sizes must match `x.shape[axis]`.\n * Can contain one -1 indicating
that dimension is to be inferred.\n * @param axis The dimension along which to split. Defaults to 0 (the first\n *
dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction split<T extends
Tensor>(x: Tensor|TensorLike, numOrSizeSplits: number[]|number, axis = 0): T[] {\n  const $x =
convertToTensor(x, 'x', 'split');\n\n  const inputs: SplitVInputs = {x: $x};\n  const attr: SplitVAttrs =
{numOrSizeSplits, axis};\n\n  return ENGINE.runKernel(\n    SplitV, inputs as {} as
NamedTensorMap,\n    attr as {} as NamedAttrMap) as {} as T[];\n}\n\nexport const split =
op({split_});\n","/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\nimport {Tensor} from '././tensor';\nimport {assert} from '././util';\nimport {complex} from
 '././complex';\nimport {concat} from './concat';\nimport {imag}
 from './imag';\nimport {op} from './operation';\nimport {real} from './real';\nimport {reshape} from
 './reshape';\nimport {slice} from './slice';\nimport {split} from './split';\nimport {zeros} from './zeros';\nimport
{zerosLike} from './zeros_like';\n\nimport {fft} from './fft';\n\n/**\n * Real value input fast Fourier transform.\n *\n *
Computes the 1-dimensional discrete Fourier transform over the\n * inner-most dimension of the real input.\n *\n *
````js\n * const real = tf.tensor1d([1, 2, 3]);\n * real.rfft().print();\n * ````\n *\n * @param input The real value
input to compute an rfft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n */\nfunction rfft_(input: Tensor, fftLength?: number): Tensor {\n assert(\n input.dtype === 'float32',\n () =>
`The dtype for rfft() must be real value but got ${input.dtype}`);\n\n let innerDimensionSize =

```

```

input.shape[input.shape.length - 1];\n const batch = input.size / innerDimensionSize;\n\n let adjustedInput: Tensor;\n if (fftLength != null && fftLength < innerDimensionSize) {\n // Need to crop\n const begin = input.shape.map(v => 0);\n const size = input.shape.map(v => v);\n size[input.shape.length - 1] =\n fftLength;\n adjustedInput = slice(input, begin, size);\n innerDimensionSize = fftLength;\n } else if (fftLength\n != null && fftLength > innerDimensionSize) {\n // Need to pad with zeros\n const zerosShape =\n input.shape.map(v => v);\n zerosShape[input.shape.length - 1] = fftLength - innerDimensionSize;\n adjustedInput = concat([input, zeros(zerosShape)], input.shape.length - 1);\n innerDimensionSize = fftLength;\n }\n else {\n adjustedInput = input;\n }\n\n // Complement the input with zero imaginary numbers.\n const zerosInput\n = zerosLike(adjustedInput);\n const complexInput =\n reshape(complex(adjustedInput, zerosInput), [batch,\n innerDimensionSize]);\n const ret = fft(complexInput);\n\n // Exclude complex conjugations.\n These conjugations are put symmetrically.\n const half = Math.floor(innerDimensionSize / 2) + 1;\n const\n realValues = real(ret);\n const imagValues = imag(ret);\n const realComplexConjugate = split(\n realValues,\n [half, innerDimensionSize - half],\n realValues.shape.length - 1);\n const imagComplexConjugate = split(\n imagValues, [half, innerDimensionSize - half],\n imagValues.shape.length - 1);\n\n const outputShape =\n adjustedInput.shape.slice();\n outputShape[adjustedInput.shape.length - 1] = half;\n\n return reshape(\n complex(realComplexConjugate[0], imagComplexConjugate[0]), outputShape);\n}\n\nexport const rfft =\n op({rfft_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n *\nimport {ENGINE} from '../engine';\nimport {Sqrt, SqrtInputs} from './kernel_names';\nimport {Tensor} from\n '../tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n**\n * Computes\n square root of the input `tf.Tensor` element-wise: `y = sqrt(x)`\n *\n * const x = tf.tensor1d([1, 2, 4, -1]);\n *\n * x.sqrt().print(); // or tf.sqrt(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations',\n subheading: 'Basic math'}\n */\nfunction\nsqrt_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sqrt');\n\n const inputs:\n SqrtInputs = {x: $x};\n\n return ENGINE.runKernel(Sqrt, inputs as { } as NamedTensorMap);\n}\n\nexport const sqrt\n = op({sqrt_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *\n *=====\n\n *\nimport {ENGINE} from '../engine';\nimport\n {SquaredDifference, SquaredDifferenceInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport\n {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport\n {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport\n {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n**\n * Returns (a - b) *\n (a - b) element-wise.\n * Supports broadcasting.\n *\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b =\n tf.tensor1d([1, 2, 9, 4]);\n *\n * a.squaredDifference(b).print(); // or tf.squaredDifference(a, b)\n *\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n *\n *=====\n
```



```

a.squaredDifference(b).print(); // or tf.squaredDifference(a, b)
@param a The first tensor.
@param b The second tensor. Must have the same type as `a`.
@doc {heading:
'Operations', subheading: 'Arithmetic'}
function squaredDifference_<T extends Tensor>(a:
Tensor|TensorLike, b: Tensor|TensorLike): T {
 let $a = convertToTensor(a, 'a', 'squaredDifference');
 let $b =
 convertToTensor(b, 'b', 'squaredDifference');
 [$a, $b] = makeTypesMatch($a, $b);
 assertAndGetBroadcastShape($a.shape, $b.shape);
 const inputs: SquaredDifferenceInputs = {a: $a, b: $b};
 const attrs = {};
 return ENGINE.runKernel(
 SquaredDifference, inputs as unknown as NamedTensorMap,
 attrs);
}
export const squaredDifference = op({squaredDifference_});
"/**
 * @license
 * Copyright 2020
 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you
 may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 *
 * http://www.apache.org/licenses/LICENSE-2.0
 *
 * Unless required by applicable law or agreed to in writing,
 software
 * distributed
 *
 * under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF
 ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
import {Tensor} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike}
from './types';
import {squeezeShape} from './util';
import {op} from './operation';
import {reshape} from
'./reshape';
/**
 * Removes dimensions of size 1 from the shape of a `tf.Tensor`.
 *
 * const x =
tf.tensor([1, 2, 3, 4], [1, 1, 4]);
 * x.squeeze().print();
 *
 * @param x The input tensor to be squeezed.
 * @param axis An optional list of numbers. If specified, only
 * squeezes the dimensions listed. The dimension
 index starts at 0. It
 * is an error to squeeze a dimension that is not 1.
 *
 * @doc {heading:
'Tensors', subheading: 'Transformations'}
function squeeze_<T extends Tensor>(x: Tensor|TensorLike, axis?:
number[]): T {
 const $x = convertToTensor(x, 'x', 'squeeze');
 return reshape($x, squeezeShape($x.shape,
axis).newShape) as T;
}
export const squeeze = op({squeeze_});
"/**
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 * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
*/
import {ENGINE} from './engine';
import {Pack, PackAttrs, PackInputs} from './kernel_names';
import
{NamedAttrMap} from './kernel_registry';
import {Tensor} from './tensor';
import {NamedTensorMap} from
'./tensor_types';
import {convertToTensorArray} from './tensor_util_env';
import {TensorLike} from
'./types';
import * as util from './util';
import {op} from './operation';
/**
 * Stacks a list of rank-`R`
 `tf.Tensor`s into one rank-`(R+1)` `tf.Tensor`.
 *
 * const a = tf.tensor1d([1, 2]);
 * const b =
tf.tensor1d([3, 4]);
 * const c = tf.tensor1d([5, 6]);
 * tf.stack([a, b, c]).print();
 *
 * @param tensors A
list of tensor objects with the same shape and dtype.
 * @param axis The axis to stack along. Defaults to 0 (the first
dim).
 *
 * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
function stack_<T extends
Tensor>(
 tensors: Array<T|TensorLike>, axis = 0): Tensor {
 const $tensors =
 convertToTensorArray(tensors, 'tensors', 'stack', 'string_or_numeric');
 util.assert(
 $tensors.length >= 1,
 () => 'Pass at least one tensor to tf.stack');
 if ($tensors.length > 0) {
 util.assert(
 axis <=
 $tensors[0].rank,
 () => 'Axis must be <= rank of the tensor');
 }
 const inputs: PackInputs = $tensors;
 const
 attrs: PackAttrs = {axis};
 return ENGINE.runKernel(
 Pack, inputs as {} as NamedTensorMap,
 attrs as {} as NamedAttrMap);
}
export const stack = op({stack_});
"/**
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 */

```

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```
=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {Step, StepAttrs, StepInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
 './types';\nimport {op} from './operation';\n\n/**\n * Computes step of the input `tf.Tensor` element-wise: `x > 0 ?
1 : alpha * x`\n *\n * ```\n * const x = tf.tensor1d([0, 2, -1, -3]);\n *\n * x.step(.5).print(); // or tf.step(x, .5)\n *\n * @param x The input tensor.\n * @param alpha The gradient when input is negative.\n *\n * @doc {heading:
'Operations', subheading: 'Basic math'}\n *\nfunction step_<T extends Tensor>(x:
T|TensorLike, alpha = 0.0): T {\n const $x = convertToTensor(x, 'x', 'step');\n const inputs: StepInputs = {x:
$x};\n const attrs: StepAttrs = {alpha};\n return ENGINE.runKernel(\n Step, inputs as {} as
NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const step = op({step_});\n", "*/\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {StridedSlice, StridedSliceAttrs, StridedSliceInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Extracts a strided slice of a tensor.\n *\n * Roughly speaking, this op extracts a slice of size (end-begin)/stride from\n * the given input tensor (x). Starting at
the location specified by begin the\n * slice continues by adding stride to the index until all dimensions are not\n *
less than end. Note that a stride can be negative, which causes a reverse\n * slice.\n *\n * ```\n * const t =
tf.tensor3d([1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6],\n * [3, 2, 3]);\n *\n * t.stridedSlice([1, 0, 0], [2, 1, 3], [1, 1,
1]).print() // [[[3, 3, 3]]]\n *\n * t.stridedSlice([1, 0, 0], [2, 2, 3], [1, 1, 1]).print() // [[[3, 3, 3],\n *
[4, 4, 4]]]\n *\n * t.stridedSlice([1, -1, 0], [2, -3, 3], [1, -1, 1]).print() // [[[4, 4, 4],\n *
[3, 3, 3]]]\n *\n * @param x The tensor to stride slice.\n * @param begin The coordinates to start the slice from.\n * @param end:
The coordinates to end the slice at.\n * @param strides: The size of the slice.\n * @param beginMask: If the ith bit
of beginMask is set, begin[i] is ignored\n * and the fullest possible range in that dimension is used instead.\n *
@param endMask: If the ith bit of endMask is set, end[i] is ignored\n * and the fullest possible range in that
dimension is used instead.\n * @param shrinkAxisMask: a bitmask where bit i implies that\n * the ith specification
should shrink the dimensionality. begin and end must\n * imply a slice of size 1 in the dimension.\n *\n * @doc
{heading:
'Operations', subheading: 'Slicing and Joining'}\n *\nfunction stridedSlice_(\n x: Tensor|TensorLike, begin:
number[], end: number[], strides?: number[],\n beginMask = 0, endMask = 0, ellipsisMask = 0, newAxisMask =
0,\n shrinkAxisMask = 0): Tensor {\n const $x = convertToTensor(x, 'x', 'stridedSlice');\n const inputs:
StridedSliceInputs = {x: $x};\n const attrs: StridedSliceAttrs = {\n begin,\n end,\n strides,\n beginMask,\n
endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n };\n return ENGINE.runKernel(\n
StridedSlice, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n}\n\nexport const stridedSlice
= op({stridedSlice_});\n", "*/\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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```

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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Tan, TanInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes tan of the input `tf.Tensor` element-wise, `tan(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\n * x.tan().print(); // or tf.tan(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction tan_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'tan');\n const inputs: TanInputs = {x: $x};\n return ENGINE.runKernel(Tan, inputs as { } as NamedTensorMap);\n}\n\nexport const tan = op({tan_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport\n {Tensor1D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike1D} from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-1 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor1d` as it makes the code more readable.\n *\n * ```js\n * tf.tensor1d([1, 2, 3]).print();\n *\n * @param values The values of the tensor. Can be array of numbers,\n * or a `TypedArray`.\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function tensor1d(values: TensorLike1D, dtype?: DataType): Tensor1D {\n assertNonNull(values);\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 1) {\n throw new Error('tensor1d() requires values to be a flat/TypedArray');\n }\n const shape: number[] = null;\n return makeTensor(values, shape, inferredShape, dtype) as Tensor1D;\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport {Tensor2D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike2D} from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-2 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor2d` as it makes the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor2d([[1, 2], [3, 4]]).print();\n *\n * // Pass a flat array and specify a shape.\n * tf.tensor2d([1, 2, 3, 4], [2, 2]).print();\n *\n * @param values The values of the tensor. Can be nested array of
```

```

numbers,\n * or a flat array, or a `TypedArray`.\n * @param shape The shape of the tensor. If not provided, it is
inferred from\n * `values`.\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading:
'Creation'}\n *\nexport function tensor2d(\n values: TensorLike2D, shape?: [number, number],\n dtype?:
DataType): Tensor2D {\n assertNonNull(values);\n if (shape
 != null && shape.length !== 2) {\n throw new Error('tensor2d() requires shape to have two numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 2 && inferredShape.length !== 1)
 {\n throw new Error(\n 'tensor2d() requires values to be number[][] or flat/TypedArray');\n }\n if
 (inferredShape.length === 1 && shape == null) {\n throw new Error(\n 'tensor2d() requires shape to be
 provided when `values` '+\n 'are a flat/TypedArray');\n }\n return makeTensor(values, shape, inferredShape,
 dtype) as Tensor2D;\n}\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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 limitations under the License.\n *

```

```

=====\n
*\n\nimport {Tensor4D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike4D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-4 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The
 same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor4d` as it makes
 the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor4d([[[[1], [2]], [[3], [4]]]]).print();\n *
  ```\n *\n * ```js\n * // Pass a flat array and specify a shape.\n * tf.tensor4d([1, 2, 3, 4], [1, 2, 2,
  1]).print();\n * ```\n *\n * @param values The values of the tensor. Can be nested array of numbers,\n *   or a flat
  array, or a `TypedArray`.\n * @param shape The shape of the tensor. Optional. If not provided,\n *   it is inferred
  from `values`.\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n
*\nexport function tensor4d(\n  values: TensorLike4D, shape?: [number, number, number, number],\n  dtype?:
  DataType): Tensor4D {\n  assertNonNull(values);\n  if (shape != null && shape.length !== 4) {\n    throw new
  Error('tensor4d() requires shape to have four numbers');\n  }\n  const inferredShape = inferShape(values, dtype);\n
  if (inferredShape.length !== 4 && inferredShape.length !== 1) {\n    throw new Error(\n      'tensor4d() requires
  values to be number[][][] or flat/TypedArray');\n  }\n  if (inferredShape.length === 1 && shape == null) {\n   
  throw new Error(\n      'tensor4d() requires shape to be provided when `values` '+\n      'are a flat array');\n  }\n
  return makeTensor(values, shape, inferredShape, dtype) as Tensor4D;\n}\n\n",/**\n * @license\n * Copyright 2018 Google
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  either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
  under the License.\n *

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```

=====\n
*\n\nimport {Tensor5D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike5D}
from './types';\nimport {DataType} from './types';\nimport
  {assertNonNull} from './util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-5 `tf.Tensor`
  with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in
  general\n * we recommend using `tf.tensor5d` as it makes the code more readable.\n *\n * ```js\n * // Pass a nested
  array.\n * tf.tensor5d([[[[[1],[2]], [[3],[4]]], [[5],[6]], [[7],[8]]]]).print();\n * ```\n *\n * ```js\n * // Pass
  a flat array and specify a shape.\n * tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]).print();\n * ```\n *\n
  * @param values The values of the tensor. Can be nested array of numbers,\n *   or a flat array, or a `TypedArray`.\n
  * @param shape

```

```

The shape of the tensor. Optional. If not provided, it is inferred from `values`.
@param dtype The data type.
@doc {heading: 'Tensors', subheading: 'Creation'}
^next export function tensor5d(
  values: TensorLike5D, shape?: [number, number, number, number, number],
  dtype?: DataType): Tensor5D {
  assertNonNull(values);
  if (shape != null && shape.length !== 5) {
    throw new Error('tensor5d() requires shape to have five numbers');
  }
  const inferredShape = inferShape(values, dtype);
  if (inferredShape.length !== 5 && inferredShape.length !== 1) {
    throw new Error('tensor5d() requires values to be a number[][][] or flat/TypedArray');
  }
  if (inferredShape.length === 1 && shape == null) {
    throw new Error('tensor5d() requires shape to be provided when `values` are a flat array');
  }
  return makeTensor(values, shape, inferredShape, dtype) as Tensor5D;
}
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 * limitations under the License.
 */
=====
import {Tensor6D} from './tensor';
import {inferShape} from './tensor_util_env';
import {TensorLike6D} from './types';
import {DataType} from './types';
import {assertNonNull} from './util';
import {makeTensor} from './tensor_ops_util';
/**
 * Creates rank-6 `tf.Tensor` with the provided values, shape and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general we recommend using `tf.tensor6d` as it makes the code more readable.
 * ```js
 * // Pass a nested array.
 * tf.tensor6d([[[[[[1],[2]],[[3],[4]]],[[5],[6]],[[7],[8]]]]]).print();
 * ```
 * ```js
 * // Pass a flat array and specify a shape.
 * tf.tensor6d([1, 2, 3, 4, 5, 6, 7, 8], [1, 1, 2, 2, 2, 1]).print();
 */
@param values The values of the tensor. Can be nested array of numbers or a flat array, or a `TypedArray`.
@param shape The shape of the tensor. Optional. If not provided, it is inferred from `values`.
@param dtype The data type.
@doc {heading: 'Tensors', subheading: 'Creation'}
^next export function tensor6d(
  values: TensorLike6D, shape?: [number, number, number, number, number, number],
  dtype?: DataType): Tensor6D {
  assertNonNull(values);
  if (shape != null && shape.length !== 6) {
    throw new Error('tensor6d() requires shape to have six numbers');
  }
  const inferredShape = inferShape(values, dtype);
  if (inferredShape.length !== 6 && inferredShape.length !== 1) {
    throw new Error('tensor6d() requires values to be number[][][] or a flat/TypedArray');
  }
  if (inferredShape.length === 1 && shape == null) {
    throw new Error('tensor6d() requires shape to be provided when `values` are a flat array');
  }
  shape = shape || inferredShape as [number, number, number, number, number, number];
  return makeTensor(values, shape, inferredShape, dtype) as Tensor6D;
}
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 * limitations under the License.
 */
=====
import {ENGINE} from './engine';
import {TopK, TopKAttrs, TopKInputs} from './kernel_names';
import {NamedAttrMap} from './kernel_registry';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import {op} from './operation';
/**
 * Finds the values and indices of the `k` largest entries along the last dimension.
 * If the input is a vector (rank=1), finds the k largest entries in the vector and outputs their values and indices as vectors. Thus values[j] is the j-th largest entry in input, and its index is

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indices[j].\n * For higher rank inputs, computes the top k entries along the last dimension.\n *\n * If two elements
are equal, the lower-index element appears first.\n *\n * ````js\n * const a = tf.tensor2d([[1, 5], [4, 3]]);\n * const
{ values,
  indices } = tf.topk(a);\n * values.print();\n * indices.print();\n * ````\n * @param x 1-D or higher `tf.Tensor` with last
dimension being at least `k`.\n * @param k Number of top elements to look for along the last dimension.\n *
@param sorted If true, the resulting `k` elements will be sorted by the\n * values in descending order.\n *\n *
@doc {heading: 'Operations', subheading: 'Evaluation'}\n *\nfunction topk_<T extends Tensor>(\n  x:
T|TensorLike, k = 1, sorted = true): { values: T, indices: T } {\n  const $x = convertToTensor(x, 'x', 'topk');\n  if
($x.rank === 0) {\n    throw new Error('topk() expects the input to be of rank 1 or higher');\n  }\n  const lastDim =
$x.shape[$x.shape.length - 1];\n  if (k > lastDim) {\n    throw new Error(\n      `k` passed to topk() must be <= the
last dimension (${lastDim})` +\n      `but got ${k}`);\n  }\n  const inputs: TopKInputs = {x: $x};\n  const attrs:
TopKAttrs = {k, sorted};\n  const [values, indices] = ENGINE.runKernel(\n
  TopK, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n  return { values, indices } as
{ values: T, indices: T};\n}\n\nexport const topk = op({topk_});\n"/**\n * @license\n * Copyright 2020 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport
{buffer} from './buffer';\nimport {op} from './operation';\nimport {MPRandGauss} from './rand_util';\n\n/**\n *
Creates a `tf.Tensor` with values sampled from a truncated normal\n * distribution.\n *\n * ````js\n *
tf.truncatedNormal([2, 2]).print();\n * ````\n *\n * The generated values follow a normal distribution with specified
mean and\n * standard deviation, except that values whose magnitude is more than 2\n * standard deviations from
the mean are dropped and re-picked.\n *\n * @param shape An array of integers defining the output tensor shape.\n *
@param mean The mean of the normal distribution.\n * @param stdDev The standard deviation of the normal
distribution.\n * @param dtype The data type of the output tensor.\n * @param seed The seed for the random
number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction truncatedNormal_<R
extends Rank>(\n  shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32',\n  seed?: number):
Tensor<R>\n  {\n    if (dtype != null && (dtype as DataType) === 'bool') {\n      throw new Error(`Unsupported data type $ { dtype
}`);\n    }\n    const randGauss =\n      new MPRandGauss(mean, stdDev, dtype, true /* truncated */, seed);\n    const res
= buffer(shape, dtype);\n    for (let i = 0; i < res.values.length; i++) {\n      res.values[i] = randGauss.nextValue();\n    }\n    return res.toTensor();\n  }\n\nexport const truncatedNormal = op({truncatedNormal_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the
specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {Unique, UniqueAttrs, UniqueInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor, Tensor1D} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert} from './util';\nimport {op} from

```

```

./operation';\n\n/**\n * Finds unique elements along an axis of a tensor.\n *\n * It returns a tensor `values`
containing all of the unique elements along the\n * `axis` of the given tensor `x` in the same order that they occur
along the\n * `axis` in `x`; `x` does not need to be sorted. It also returns a tensor\n * `indices` the same size as the
number of the elements in `x` along the `axis`\n * dimension. It contains the index in the
unique output `values`.\n *\n * ```js\n * // A 1-D tensor\n * const a = tf.tensor1d([1, 1, 2, 4, 4, 4, 7, 8, 8]);\n * const
{values, indices} = tf.unique(a);\n * values.print(); // [1, 2, 4, 7, 8,]\n * indices.print(); // [0, 0, 1, 2, 2, 2, 3, 4, 4]\n
* ```\n *\n * ```js\n * // A 2-D tensor with axis=0\n * //\n * // 'a' is: [[1, 0, 0],\n * // [1, 0, 0],\n * // [2, 0,
0]]\n * const a = tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);\n * const {values, indices} = tf.unique(a, 0)\n *
values.print(); // [[1, 0, 0],\n * // [2, 0, 0]]\n * indices.print(); // [0, 0, 1]\n * ```\n *\n * ```js\n * // A 2-
D tensor with axis=1\n * //\n * // 'a' is: [[1, 0, 0],\n * // [1, 0, 0],\n * // [2, 0, 0]]\n * const a =
tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);\n * const {values, indices} = tf.unique(a, 1)\n * values.print(); // [[1, 0],\n
* // [1, 0],\n * // [2, 0]]\n * indices.print(); // [0, 1, 1]\n
* ```\n * @param x A tensor (int32, string, bool).\n * @param axis The axis of the tensor to find the unique
elements.\n * @returns [uniqueElements, indices] (see above for details)\n *\n * @doc {heading: 'Operations',
subheading: 'Evaluation'}\n */\nfunction unique_<T extends Tensor>(\n  x: T|TensorLike, axis = 0): {values: T,
indices: Tensor1D} {\n  const $x = convertToTensor(x, 'x', 'unique', 'string_or_numeric');\n  assert($x.rank > 0, ()
=> 'The input tensor must be at least 1D');\n\n  const inputs: UniqueInputs = {x: $x};\n  const attrs: UniqueAttrs =
{axis};\n  const [values, indices] = ENGINE.runKernel(\n\n    Unique, inputs as {} as
NamedTensorMap,\n\n    attrs as {} as NamedAttrMap) as [T, Tensor1D];\n  return {values,
indices};\n}\n\nexport const unique = op({unique_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {UnsortedSegmentSum, UnsortedSegmentSumAttrs,
UnsortedSegmentSumInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor, Tensor1D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert, isInt} from
'./util';\n\nimport
{op} from './operation';\n\n/**\n * Computes the sum along segments of a `tf.Tensor`.\n *\n * ```js\n * const x =
tf.tensor1d([1, 2, 3, 4]);\n * const segmentIds = tf.tensor1d([1, 2, 0, 1], 'int32');\n * const numSegments = 3;\n *\n * x.unsortedSegmentSum(segmentIds, numSegments).print()\n * // or tf.unsortedSegmentSum(x, segmentIds,
numSegments)\n * ```\n *\n * @param x The `tf.Tensor` that will be summed along its segments.\n * @param
segmentIds A `tf.Tensor1D` whose rank is equal to the rank of `x`'s\n * dimension along the `axis`. Maps each
element of `x` to a segment.\n * @param numSegments The number of distinct `segmentIds`.\n *\n * @doc
{heading: 'Operations', subheading: 'Segment'}\n */\nfunction unsortedSegmentSum_<T extends Tensor>(\n  x:
T|TensorLike, segmentIds: Tensor1D|TensorLike, numSegments: number): T {\n  const $x = convertToTensor(x, 'x',
'unsortedSegmentSum');\n  const $segmentIds =\n    convertToTensor(segmentIds, 'segmentIds',
'unsortedSegmentSum', 'int32');\n  assert(isInt(numSegments),
  () => 'numSegments must be of dtype int');\n\n  const inputs: UnsortedSegmentSumInputs = {x: $x, segmentIds:
$segmentIds};\n  const attrs: UnsortedSegmentSumAttrs = {numSegments};\n\n  return ENGINE.runKernel(\n
UnsortedSegmentSum, inputs as {} as NamedTensorMap,\n\n  attrs as {} as NamedAttrMap);\n}\n\nexport const
unsortedSegmentSum = op({unsortedSegmentSum_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

```

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```
=====
*
*import {ENGINE} from './engine';import {Unpack, UnpackAttrs, UnpackInputs} from
 './kernel_names';import {NamedAttrMap} from './kernel_registry';import {Tensor} from './tensor';import
 {NamedTensorMap} from './tensor_types';import {convertToTensor} from './tensor_util_env';import
 {TensorLike} from './types';import * as util from './util';import {op} from './operation';
* Unstacks a
`tf.Tensor` of rank-`R` into a list of rank-`(R-1)` `tf.Tensor`s.
* ` `js
* const a = tf.tensor2d([1, 2, 3, 4], [2,
2]);
* tf.unstack(a).forEach(tensor => tensor.print());
* ` `
* @param x A tensor object.
* @param
axis The axis to unstack along. Defaults to 0 (the first dim).
* @doc {heading: 'Tensors', subheading: 'Slicing
and Joining'}
*function unstack_(x: Tensor|TensorLike, axis = 0): Tensor[] {
  const $x = convertToTensor(x,
'x', 'unstack', 'string_or_numeric');
  util.assert((axis >= -$x.shape.length && axis < $x.shape.length,
()
=> `Axis = ${axis} is not in [-$x.shape.length, $x.shape.length]`));
  const inputs: UnpackInputs =
{value: $x};
  const attrs: UnpackAttrs = {axis};
  return ENGINE.runKernel(Unpack, inputs as
NamedTensorMap, attrs as {} as NamedAttrMap);
}
*next export const unstack = op({unstack_});
*
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limitations under the License.

```

```
=====
*
*import {ENGINE} from './engine';import {Tensor, Variable} from './tensor';import {DataType, Rank}
 from './types';
* Creates a new variable with the provided initial value.
* ` `js
* const x =
tf.variable(tf.tensor([1, 2, 3]));
* x.assign(tf.tensor([4, 5, 6]));
* x.print();
* ` `
* @param initialValue
Initial value for the tensor.
* @param trainable If true, optimizers are allowed to update it.
* @param name
Name of the variable. Defaults to a unique id.
* @param dtype If set, initialValue will be converted to the given
type.
* @doc {heading: 'Tensors', subheading: 'Creation'}
*next export function variable<R extends Rank>(
initialValue: Tensor<R>, trainable = true, name?: string,
dtype?: DataType): Variable<R> {
  return
ENGINE.makeVariable(initialValue,
trainable, name, dtype) as
Variable<R>;
}
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```

```
=====
*
* An implementation of the Where kernel shared between cpu and WebGL
*import {buffer} from
 './ops/buffer';import {Tensor2D} from './tensor';import {TypedArray} from './types';
*next export function
whereImpl(condShape: number[], condVals: TypedArray): Tensor2D {
  const indices = [];
  for (let i = 0; i <
condVals.length; i++) {
    if (condVals[i]) {
      indices.push(i);
    }
  }
  const inBuffer =
buffer(condShape, 'int32');
  const out = buffer([indices.length, condShape.length], 'int32');
  for (let i = 0; i <
indices.length; i++) {
    const loc = inBuffer.indexToLoc(indices[i]);
    const offset = i * condShape.length;
    out.values.set(loc, offset);
  }
  return out.toTensor() as Tensor2D;
}
*
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```


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```
=====\n *\nimport {whereImpl} from './backends/where_impl';\nimport {Tensor, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\n/**\n * Returns the coordinates of true elements of condition.\n * The coordinates are returned in a 2-D tensor where the first dimension (rows)\n * represents the number of true elements, and the second dimension (columns)\n * represents the coordinates of the true elements. Keep in mind, the shape of\n * the output tensor can vary depending on how many true values there are in\n * input. Indices are output in row-major order. The resulting tensor has the\n * shape [numTrueElems, condition.rank].\n * This is analogous to calling the\n * python `tf.where(cond)` without an x or y.\n * `js`\n * const cond = tf.tensor1d([false, false, true], 'bool');\n * const result = await tf.whereAsync(cond);\n * result.print();\n * ```\n * @doc {heading: 'Operations',\n * subheading: 'Logical'}\n */\nexport function whereAsync_(condition: Tensor|TensorLike): Promise<Tensor2D> {\n  const $condition =\n    convertToTensor(condition, 'condition', 'whereAsync', 'bool');\n  const vals = await\n    $condition.data();\n  const res = whereImpl($condition.shape, vals);\n  if (condition !== $condition) {\n    $condition.dispose();\n  }\n  return res;\n}\n\nexport const whereAsync = whereAsync_;\n", "*/\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {gather} from './gather';\nimport {reshape} from './reshape';\nimport {squeeze} from './squeeze';\nimport {whereAsync} from './where_async';\n\n/**\n * Apply boolean mask to tensor.\n * `js`\n * const tensor = tf.tensor2d([1, 2, 3, 4, 5, 6], [3, 2]);\n * const mask = tf.tensor1d([1, 0, 1], 'bool');\n * const result = await tf.booleanMaskAsync(tensor, mask);\n * result.print();\n * ```\n * @param tensor N-D tensor.\n * @param mask K-D boolean tensor, K <= N and K must be known statically.\n * @param axis A 0-D int Tensor representing the axis in tensor to mask from.\n * By default, axis is 0 which will mask from the first dimension.\n * Otherwise K + axis <= N.\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nexport function booleanMaskAsync_(\n  tensor: Tensor|TensorLike, mask: Tensor|TensorLike, axis?: number):\n  Promise<Tensor> {\n  const $tensor = convertToTensor(tensor, 'tensor', 'booleanMask');\n  const $mask =\n    convertToTensor(mask, 'mask', 'booleanMask', 'bool');\n  const axisFrom = axis == null ? 0 : axis;\n  const maskDim = $mask.rank;\n  const tensorShape = $tensor.shape;\n  util.assert(maskDim > 0, () => 'mask cannot be scalar');\n  util.assertShapesMatch(\n    tensorShape.slice(axisFrom, axisFrom + maskDim), $mask.shape,\n    `mask's shape must match the first K dimensions of tensor's shape.`);\n  let leadingSize = 1;\n  for (let i = axisFrom; i < axisFrom + maskDim; i++)\n    {\n    leadingSize *= tensorShape[i];\n    }\n  const targetTensorShape =\n    tensorShape.slice(0, axisFrom)\n    .concat([leadingSize, tensorShape.slice(axisFrom + maskDim)]);\n  const reshapedTensor = reshape($tensor, targetTensorShape);\n  const reshapedMask = reshape($mask, [-1]);\n  const positivePositions = await\n    whereAsync(reshapedMask);\n  const indices = squeeze(positivePositions, [1]);\n  const res =\n    gather(reshapedTensor, indices, axisFrom);\n  // Ensure no memory leak.\n  if (tensor !== $tensor) {\n
```

```

$tensor.dispose();\n }\n if (mask !== $mask) {\n  $mask.dispose();\n }\n indices.dispose();\n
reshapedTensor.dispose();\n reshapedMask.dispose();\n positivePositions.dispose();\n\n return res;\n}\n\nexport
const booleanMaskAsync = booleanMaskAsync_;\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
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=====
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport {parseAxisParam} from './util';\n\nimport {abs} from './abs';\nimport * as axis_util from
 './axis_util';\nimport {max} from './max';\nimport {min} from './min';\nimport {op} from './operation';\nimport
 {pow} from './pow';\nimport {reshape} from './reshape';\nimport {scalar} from './scalar';\nimport {sqrt} from
 './sqrt';\nimport {square} from
 './square';\nimport {sum} from './sum';\n\n/**\n * Computes the norm of scalar, vectors, and matrices.\n * This
function can compute several different vector norms (the 1-norm, the\n * Euclidean or 2-norm, the inf-norm, and in
general the p-norm for p > 0)\n * and matrix norms (Frobenius, 1-norm, and inf-norm).\n *\n * ``js\n * const x =
tf.tensor1d([1, 2, 3, 4]);\n *\n * x.norm().print(); // or tf.norm(x)\n *\n * @param x The input array.\n *
@param ord Optional. Order of the norm. Supported norm types are\n * following:\n *\n * | ord      | norm for
matrices      | norm for vectors\n * |-----|-----|-----|-----\n * | 'euclidean' |Frobenius
norm      |2-norm\n * |'fro'   |Frobenius norm|t      |Infinity |max(sum(abs(x), axis=1))\n
|max(abs(x))\n * |-Infinity |min(sum(abs(x), axis=1)) |min(abs(x))\n * |1      |max(sum(abs(x), axis=0))\n
|sum(abs(x))\n * |2      |
|sum(abs(x)^2)^1/2*\n *\n * @param axis Optional. If axis is null (the default), the input is\n * considered a vector
and a single vector norm is computed over the entire\n * set of values in the Tensor, i.e. norm(x, ord) is equivalent\n
 * to norm(x.reshape([-1]), ord). If axis is a integer, the input\n * is considered a batch of vectors, and axis
determines the axis in x\n * over which to compute vector norms. If axis is a 2-tuple of integer it is\n * considered a
batch of matrices and axis determines the axes in NDArray\n * over which to compute a matrix norm.\n * @param
keepDims Optional. If true, the norm have the same dimensionality\n * as the input.\n *\n * @doc {heading:
'Operations', subheading: 'Matrices'}\n *\nfunction norm_(\n  x: Tensor|TensorLike, ord: number|'euclidean'|'fro' =
'euclidean',\n  axis: number|number[] = null, keepDims = false): Tensor {\n  x = convertToTensor(x, 'x',
'norm');\n  const norm = normImpl(x, ord, axis);\n  let keepDimsShape = norm.shape;\n
  if (keepDims) {\n    const axes = parseAxisParam(axis, x.shape);\n    keepDimsShape =
axis_util.expandShapeToKeepDim(norm.shape, axes);\n  }\n  return reshape(norm,
keepDimsShape);\n}\n\nfunction normImpl(\n  x: Tensor, p: number|string, axis: number|number[] = null): Tensor
{\n  if (x.rank === 0) {\n    return abs(x);\n  }\n  // consider vector when no axis is specified\n  if (x.rank !== 1 &&
axis === null) {\n    return normImpl(reshape(x, [-1]), p, axis);\n  }\n  // vector\n  if (x.rank === 1 || typeof axis
=== 'number' ||\n    Array.isArray(axis) && axis.length === 1) {\n    if (p === 1) {\n      return sum(abs(x), axis);\n
    }\n    if (p === Infinity) {\n      return max(abs(x), axis);\n    }\n    if (p === -Infinity) {\n      return min(abs(x),
axis);\n    }\n    if (p === 'euclidean' || p === 2) {\n      // norm(x, 2) = sum(abs(xi) ^ 2) ^ 1/2\n      return
sqrt(sum(pow(abs(x), scalar(2, 'int32')), axis));\n    }\n    throw new Error(`Error in norm: invalid ord value:
${p}`);\n  }\n  // matrix (assumption axis[0] < axis[1])\n  if (Array.isArray(axis) && axis.length === 2) {\n    if (p
=== 1) {\n      return max(sum(abs(x), axis[0]), axis[1] - 1);\n    }\n    if (p === Infinity) {\n      return
max(sum(abs(x), axis[1]), axis[0]);\n    }\n    if (p === -Infinity) {\n      return min(sum(abs(x), axis[1]), axis[0]);\n
    }\n    if (p === 'fro' || p === 'euclidean') {\n      // norm(x) = sqrt(sum(pow(x, 2)))\n      return sqrt(sum(square(x),
axis));\n    }\n    throw new Error(`Error in norm: invalid ord value: ${p}`);\n  }\n  throw new Error(`Error in
norm: invalid axis: ${axis}`);\n}\n\nexport const norm = op({norm_});\n", "/*\n * @license\n * Copyright 2018

```

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```
=====\n*\n\nimport {Scalar, Tensor} from './tensor';\nimport {assertTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {add} from './add';\nimport {div} from './div';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {pow} from './pow';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\n/**\n * Compute the moving average of a variable.\n * Without zeroDebias, the moving average operation is defined by:\n *  $v += \delta$  where  $\delta = (1 - \text{decay}) * (x - v)$ \n * With zeroDebias (default), the  $\delta$  term is scaled to debias the\n * effect of the (assumed) zero-initialization of  $v$ .  $\delta /= (1 - \text{decay} ^ \text{step})$ \n * For more details on the zero-debiasing algorithm, see:\n * https://arxiv.org/abs/1412.6980\n * Note that this function is completely stateless and does not keep track of\n * step count. The step count needs to be maintained by the caller and passed\n * in as `step`.\n * @param v The current moving average value.\n * @param x New input value, must have the same shape and dtype as `v`.\n * @param decay The decay factor. Typical values are 0.95 and 0.99.\n * @param step Step count.\n * @param zeroDebias: Whether zeroDebias is to be performed (default: `true`).\n * @returns The new moving average value.\n * @doc {heading: 'Operations', subheading: 'Moving Average'}\n */\nfunction movingAverage<T extends Tensor>(\n  v: T|TensorLike, x: T|TensorLike, decay: number|Scalar, step?:\n  number|Scalar, zeroDebias = true): T {\n  const $v = convertToTensor(v, 'v', 'movingAverage');\n  const $x = convertToTensor(x, 'x', 'movingAverage');\n  const $decay = convertToTensor(decay, 'decay', 'movingAverage');\n  assertTypesMatch($v, $x);\n  util.assert(\n    util.arraysEqual($v.shape, $x.shape), () => 'Shape mismatch in v and x');\n  const one = scalar(1);\n  const oneMinusDecay = sub(one, $decay);\n  let update = mul(sub($x, $v), oneMinusDecay);\n  if (zeroDebias) {\n    util.assert(\n      step != null, () => 'When using zeroDebias: true, step is required.);\n    const $step = convertToTensor(step, 'step', 'movingAverage');\n    update = div(update, sub(one, pow($decay, $step)));\n  }\n  return add($v, update);\n}\n\nexport const movingAverage =\n  op({movingAverage_});\n\n/**\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {ScatterNd, ScatterNdAttrs, ScatterNdInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, ShapeMap, TensorLike} from './types';\nimport {op} from './operation';\nimport * as scatter_nd_util from './scatter_nd_util';\n\n/**\n * Creates a new tensor by applying sparse updates to individual\n * values or slices within a zero tensor of the given shape tensor\n * according to\n * indices. This operator is the inverse of the `tf.gatherND` operator which\n * extracts values or slices from a given tensor.\n *  $\text{const indices} = \text{tf.tensor2d}([4, 3, 1, 7], [4, 1], 'int32');$ \n *  $\text{const updates} = \text{tf.tensor1d}([9, 10, 11, 12]);$ \n *  $\text{const shape} = [8];$ \n *  $\text{tf.scatterND}(\text{indices}, \text{updates}, \text{shape}).\text{print}() // [0, 11, 0, 10, 9, 0, 0, 12]$ \n * @param indices The tensor contains the indices into the output tensor.\n * @param updates The tensor contains the value for the indices.\n * @param shape: The shape of the output tensor.\n * @doc
```

```

{heading: 'Operations', subheading: 'Slicing and Joining'}\n *\nfunction scatterND_<R extends Rank>(\n  indices:
Tensor|TensorLike, updates: Tensor|TensorLike,\n  shape: ShapeMap[R]): Tensor<R> {\n  const $indices =
convertToTensor(indices, 'indices', 'scatterND', 'int32');\n  const $updates
= convertToTensor(updates, 'updates', 'scatterND');\n  scatter_nd_util.validateInput($updates, $indices, shape);\n\n  const inputs: ScatterNdInputs = {indices: $indices, updates: $updates};\n  const attrs: ScatterNdAttrs = {shape};\n\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  return ENGINE.runKernel(\n    ScatterNd, inputs
as {} as NamedTensorMap,\n    attrs as {} as NamedAttrMap) as Tensor<R>;\n}\n\nexport const scatterND =
op({scatterND_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\nimport {Tensor} from './tensor';\n\n/*\n * Validate sparseToDense inputs.\n *\n * @param sparseIndices A 0-
D, 1-D, or 2-D Tensor of type int32.\n * sparseIndices[i] contains the complete index where sparseValues[i] will
be\n * placed.\n * @param sparseValues A 0-D or 1-D Tensor. Values\n * corresponding to each row of
sparseIndices, or a scalar value to be used for\n * all sparse indices.\n * @param outputShape number[]. Shape of
the dense output tensor.\n * @param validateIndices boolean. indice validation is not supported, error\n * will be
thrown if it is set.\n *\nexport function validateInput(\n  sparseIndices: Tensor, sparseValues: Tensor,\n  outputShape: number[],\n  defaultValues: Tensor) {\n  if (sparseIndices.dtype !== 'int32') {\n    throw new Error(\n      'tf.sparseToDense()
expects the indices to be int32 type,' +\n      ` but the dtype was ${sparseIndices.dtype}.`);\n  }\n  if
(sparseIndices.rank > 2) {\n    throw new Error(\n      'sparseIndices should be a scalar, vector, or matrix,' +\n      `
but got shape ${sparseIndices.shape}.`);\n  }\n  const numElems = sparseIndices.rank > 0 ? sparseIndices.shape[0]
: 1;\n  const numDims = sparseIndices.rank > 1 ? sparseIndices.shape[1] : 1;\n  if (outputShape.length !==
numDims) {\n    throw new Error(\n      'outputShape has incorrect number of elements,' +\n      `
${outputShape.length}, should be: ${numDims}.`);\n  }\n  const numValues = sparseValues.size;\n  if
(!(sparseValues.rank === 0 ||\n    sparseValues.rank === 1 && numValues === numElems)) {\n    throw new
Error(\n      'sparseValues has incorrect shape ' +\n      ` ${sparseValues.shape}, should be [] or
[${numElems}]`);\n  }\n  if (sparseValues.dtype !== defaultValues.dtype) {\n    throw new
Error('sparseValues.dtype
must match defaultValues.dtype');\n  }\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport {ENGINE} from './engine';\nimport {SparseToDense, SparseToDenseAttrs, SparseToDenseInputs}
from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport * as sparse_to_dense from
 './ops/sparse_to_dense_util';\nimport
{Scalar, Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor}
from './tensor_util_env';\nimport {Rank, ScalarLike, ShapeMap, TensorLike} from './types';\n\nimport {op} from
 './operation';\n\n/*\n * Converts a sparse representation into a dense tensor.\n *\n * Builds an array dense with
shape outputShape such that:\n *\n * // If sparseIndices is scalar\n * dense[i] = (i == sparseIndices ? sparseValues :

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defaultValue)\n *\n * // If sparseIndices is a vector, then for each i\n * dense[sparseIndices[i]] = sparseValues[i]\n *\n * // If sparseIndices is an n by d matrix, then for each i in [0, n)\n * dense[sparseIndices[i][0], ...,
sparseIndices[i][d-1]] = sparseValues[i]\n * All other values in dense are set to defaultValue. If sparseValues is a\n *
scalar, all sparse indices are set to this single value.\n *\n * If indices are repeated the final value is summed over all
values for those\n * indices.\n *\n * ```\n *
*\n * const indices = tf.tensor1d([4, 5, 6, 1, 2, 3], 'int32');\n * const values = tf.tensor1d([10, 11, 12, 13, 14, 15],
'float32');\n * const shape = [8];\n * tf.sparseToDense(indices, values, shape).print();\n * ```\n *\n * @param
sparseIndices A 0-D, 1-D, or 2-D Tensor of type int32.\n * sparseIndices[i] contains the complete index where
sparseValues[i] will be\n * placed.\n * @param sparseValues A 0-D or 1-D Tensor. Values\n * corresponding to
each row of sparseIndices, or a scalar value to be used for\n * all sparse indices.\n * @param outputShape Shape of
the dense output tensor. the type is inferred.\n * @param defaultValue Scalar. Value to set for indices not specified
in\n * sparseIndices. Defaults to zero.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n
*\n * \nfunction sparseToDense_<R extends Rank>(\n   sparseIndices: Tensor|TensorLike, sparseValues:
Tensor|TensorLike,\n   outputShape: ShapeMap[R], defaultValue: Scalar|ScalarLike = 0): Tensor<R> {\n   const
$sparseIndices =\n     convertToTensor(sparseIndices, 'sparseIndices', 'sparseToDense', 'int32');\n   const
$sparseValues =\n     convertToTensor(sparseValues, 'sparseValues', 'sparseToDense');\n   const $defaultValue =
convertToTensor(\n     defaultValue, 'defaultValue', 'sparseToDense', $sparseValues.dtype);\n   \n   sparse_to_dense.validateInput(\n     $sparseIndices, $sparseValues, outputShape, $defaultValue);\n   \n   const inputs:
SparseToDenseInputs = {\n     sparseIndices: $sparseIndices,\n     sparseValues: $sparseValues,\n     defaultValue:
$defaultValue\n   };\n   \n   const attrs: SparseToDenseAttrs = {outputShape};\n   \n   return ENGINE.runKernel(\n
SparseToDense, inputs as {} as NamedTensorMap,\n     attrs as {} as NamedAttrMap);\n   \n   \n   \nexport const
sparseToDense = op({sparseToDense_});\n *,"/*\n * @license\n * Copyright 2018 Google LLC. All Rights
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the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*\n * \nimport {ENGINE} from '../engine';\n * \nimport {GatherNd, GatherNdInputs} from '../kernel_names';\n * \nimport
{Tensor} from '../tensor';\n * \nimport {NamedTensorMap} from '../tensor_types';\n * \nimport {convertToTensor} from
'../tensor_util_env';\n * \nimport {TensorLike} from '../types';\n * \nimport {op} from './operation';\n * \n/*\n * Gather slices
from input tensor into a Tensor with shape specified by\n * `indices`.\n *\n * `indices` is an K-dimensional integer
tensor, best thought of as
a\n * (K-1)-dimensional tensor of indices into input, where each element defines a\n * slice of input:\n *
output[\\(i_0, ..., i_{K-2}\\)] = input[indices[\\(i_0, ..., i_{K-2}\\)]]\n *\n * Whereas in `tf.gather`, `indices`
defines slices into the first dimension of\n * input, in `tf.gatherND`, `indices` defines slices into the first N
dimensions\n * of input, where N = indices.shape[-1].\n *\n * The last dimension of indices can be at most the rank
of input:\n * indices.shape[-1] <= input.rank\n *\n * The last dimension of `indices` corresponds to elements\n * (if
indices.shape[-1] == input.rank) or slices\n * (if indices.shape[-1] < input.rank) along dimension indices.shape[-1]
of\n * input.\n *\n * The output tensor has shape\n * indices.shape[:-1] + input.shape[indices.shape[-1]:]\n *\n * Note
that on CPU, if an out of bound index is found, an error is returned. On\n * GPU, if an out of bound index is found,
a 0 is stored in the corresponding\n * output value.\n *\n * ```\n *
*\n * const indices = tf.tensor2d([0, 1, 1, 0], [2,2], 'int32');\n * const input = tf.tensor2d([9, 10, 11, 12], [2, 2]);\n *
tf.gatherND(input, indices).print() // [10, 11]\n * ```\n *\n * @param x The tensor from which to gather values.\n *
@param indices Index tensor, must be of type int32.\n *\n * @doc {heading: 'Operations', subheading: 'Slicing and
Joining'}\n * \nfunction gatherND_(x: Tensor|TensorLike, indices: Tensor|TensorLike): Tensor {\n   const $indices =

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convertToTensor(indices, 'indices', 'gatherND', 'int32');\n const $x = convertToTensor(x, 'x', 'gatherND');\n\n const\n inputs: GatherNdInputs = {params: $x, indices: $indices};\n\n return ENGINE.runKernel(GatherNd, inputs as { } as\n NamedTensorMap);\n}\n\nexport const gatherND = op({gatherND_});\n", "/*\n * @license\n * Copyright 2019\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy\n of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *  
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\n\n */\n\nimport {Tensor} from './tensor';\nimport * as util from './util';\n\n/**\n * Normalize noise shape based on\n provided tensor and noise shape.\n * @param x Tensor.\n * @param noiseShape The shape for the randomly\n generated keep/drop flags, as\n * an array of numbers. Optional.\n * @returns Normalized noise shape.\n */\nexport function getNoiseShape(x: Tensor, noiseShape?: number[]): number[] {\n if (noiseShape == null) {\n return x.shape.slice();\n }\n if (util.arraysEqual(x.shape, noiseShape)) {\n return noiseShape;\n }\n if (x.shape.length === noiseShape.length) {\n const newDimension: number[] =\n [];\n for (let i = 0; i < x.shape.length; i++) {\n if (noiseShape[i] == null && x.shape[i] != null) {\n newDimension.push(x.shape[i]);\n } else {\n newDimension.push(noiseShape[i]);\n }\n }\n return\n newDimension;\n }\n\n return noiseShape;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions\n and\n * limitations under the License.\n *  
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\n\n */\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}\n from './types';\nimport * as util from './util';\nimport {add} from './add';\nimport {div} from './div';\nimport\n {getNoiseShape} from './dropout_util';\nimport {floor} from './floor';\nimport {mul} from './mul';\nimport {op}\n from './operation';\nimport {randomUniform} from './random_uniform';\n\n/**\n * Computes dropout.\n * ```\n * const x = tf.tensor1d([1, 2, 2, 1]);\n * const rate = 0.75;\n * const output = tf.dropout(x, rate);\n * output.print();\n * ```\n * @param x A floating point Tensor or TensorLike.\n * @param rate A float in the range [0, 1). The\n probability that each element\n * of x is discarded.\n * @param noiseShape An array of numbers of type int32,\n representing the\n * shape for randomly generated keep/drop flags. If the\n noiseShape has null\n * value, it will be automatically replaced with the x's relative dimension\n * size. Optional.\n * @param seed Used to create random seeds. Optional.\n * @returns A Tensor of the same shape of x.\n * @doc\n {heading: 'Operations', subheading: 'Dropout'}\n */\nfunction dropout_(\n x: Tensor|TensorLike, rate: number,\n noiseShape?: number[],\n seed?: number|string): Tensor {\n const $x = convertToTensor(x, 'x', 'dropout');\n\n util.assert(\n $x.dtype === 'float32',\n () => `x has to be a floating point tensor since it's going to be ` +\n `scaled, but got a ${$x.dtype} tensor instead.`);\n util.assert(\n rate >= 0 && rate < 1,\n () => `rate must be a\n float in the range [0, 1), but got ${rate}.`);\n\n if (rate === 0) {\n return x instanceof Tensor ? $x.clone() : $x;\n }\n\n const $noiseShape = getNoiseShape($x, noiseShape);\n const keepProb = 1 - rate;\n const multiplier = div(\n floor(add(randomUniform($noiseShape,\n 0, 1, 'float32', seed), keepProb)),\n keepProb);\n\n return mul($x, multiplier);\n}\n\nexport const dropout =\n op({dropout_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *  
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*\n\nimport {Tensor1D} from './tensor';\nimport {tensor1d} from './tensor1d';\n\nexport function\nenclosingPowerOfTwo(value: number) {\n // Return\n 2**N for integer N such that 2**N >= value.\n return Math.floor(Math.pow(2, Math.ceil(Math.log(value) /\nMath.log(2.0))));\n}\n\nexport function cosineWindow(\n windowLength: number, a: number, b: number):\nTensor1D {\n const even = 1 - windowLength % 2;\n const newValues = new Float32Array(windowLength);\n for\n (let i = 0; i < windowLength; ++i) {\n const cosArg = (2.0 * Math.PI * i) / (windowLength + even - 1);\n newValues[i] = a - b * Math.cos(cosArg);\n } \n return tensor1d(newValues, 'float32');\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n
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*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}\nfrom './types';\nimport {assert, assertShapesMatch, getTypedArrayFromDType} from './util';\nimport {tensor}\nfrom './tensor';\n\n/**\n * Returns whether the targets are in the top K predictions.\n */\nexport function inTopK(\n predictions: tf.Tensor2d|[20, 10, 40, 30], [30, 50, -20, 10]);\n targets: tf.Tensor1d|[2, 0]);\n precision: Awaitable<tf.Tensor>\nwith last dimension being\n at least `k`.\n @param targets 1-D or higher `tf.Tensor`.\n @param k Optional\nNumber of top elements to look at for computing precision,\n * default to 1.\n @doc {heading: 'Operations', subheading: 'Evaluation'}\n\ninTopKAsync_<T extends Tensor, U extends Tensor>(\n predictions: T|TensorLike, targets: U|TensorLike, k = 1):\nPromise<U> {\n const $predictions = convertToTensor(predictions, 'predictions', 'inTopK');\n const $targets =\nconvertToTensor(targets, 'targets', 'inTopK');\n assert(\n $predictions.rank > 1,\n () => 'inTopK() expects\nthe predictions to be of rank 2 or higher, '\n +\n `but got ${$predictions.rank}`);\n assert(\n $predictions.rank\n - 1 === $targets.rank,\n () => `predictions rank should be 1 larger than ` +\n `targets rank, but got\npredictions rank ` +\n `${$predictions.rank}` and targets rank `${$targets.rank}`);\n assertShapesMatch(\n $predictions.shape.slice(0, $predictions.shape.length - 1),\n $targets.shape,\n `predictions's shape should be\nalign with the targets' shape, ` +\n `except the\nlast dimension.`);\n const lastDim = $predictions.shape[$predictions.shape.length - 1];\n assert(\n k > 0 && k\n <= lastDim,\n () => `k' passed to inTopK() must be > 0 && <= the predictions last ` +\n `dimension\n(${lastDim}), but got ${k}`);\n\n const predictionsVals = await $predictions.data();\n const targetsVals = await\n$targets.data();\n // Reshape predictionsVals into a 2d tensor [batch, lastDim]\n // and look up topK along\nlastDim.\n const [batch, size] = [predictionsVals.length / lastDim, lastDim];\n const precision =\ngetTypedArrayFromDType('bool', batch);\n for (let b = 0; b < batch; b++) {\n const offset = b * size;\n const\nvals = predictionsVals.subarray(offset, offset + size);\n const valAndInd: Array<{value: number, index: number}>\n= [];\n for (let i = 0; i < vals.length; i++) {\n valAndInd.push({value: vals[i], index: i});\n }\nvalAndInd.sort((a, b) => b.value - a.value);\n\n precision[b] = 0;\n for (let i = 0;\ni < k; i++) {\n if (valAndInd[i].index === targetsVals[b]) {\n precision[b] = 1;\n break;\n }\n }\n}\n\n if (predictions !== $predictions) {\n $predictions.dispose();\n }\n if (targets !== $targets) {\n $targets.dispose();\n }\n\n // Output precision has the same shape as targets.\n return tensor(precision,\n
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\$targets.shape, 'bool') as U;\n}\n\nexport const inTopKAsync = inTopKAsync_;\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\nimport {ENGINE} from './engine';\nimport {Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from './util';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the derivative of the filter of a 2D convolution.\n *\n * @param x The input tensor, of rank 4 or rank 3 of shape\n *   [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n * @param dy The dy image, of rank 4 or rank 3, of shape\n *   [batch, height, width, outDepth]. If rank 3, batch of 1 is assumed.\n * @param filterShape The shape of the filter, length 4,\n *   [filterHeight, filterWidth, inDepth, outDepth].\n * @param strides The strides of the convolution:\n *   [strideHeight, strideWidth].\n * @param pad A string from: 'same', 'valid'. The type of padding algorithm\n *   used in the forward prop of the op.\n * @param dataFormat: An optional string from: \"NHWC\", \"NCHW\". Defaults to\n *   \"NHWC\". Specify the data format of the input and output data. With the\n *   default format \"NHWC\", the data is stored in the order of: [batch,\n *   height, width, channels].\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n *   provided, it will default to truncate.\n */\nfunction conv2DBackpropFilter_<T extends Tensor3D|Tensor4D>(\n  x: T, dy: T, filterShape: [number, number, number, number],\n  strides: [number, number]|number, pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n  dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n  dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {\n  let x4D = x as Tensor4D;\n  if (x.rank === 3) {\n    x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n  }\n  let dy4D = dy as Tensor4D;\n  if (dy4D.rank === 3) {\n    dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n  }\n  util.assert(\n    x4D.rank === 4,\n    () => `Error in conv2dDerFilter: input must be rank 4, but got shape ` +\n      `${x4D.shape}.`);\n  util.assert(\n    dy4D.rank === 4,\n    () => `Error in conv2dDerFilter: dy must be rank 4, but got shape ` +\n      `${dy4D.shape}.`);\n  util.assert(\n    filterShape.length === 4,\n    () => `Error in conv2dDerFilter: filterShape must be length 4, but got ` +\n      `${filterShape}.`);\n  const inDepth = dataFormat === 'NHWC' ? x4D.shape[3] : x4D.shape[1];\n  const outDepth = dataFormat === 'NHWC' ? dy4D.shape[3] : dy4D.shape[1];\n  util.assert(\n    inDepth === filterShape[2],\n    () => `Error in conv2dDerFilter: depth of input ${inDepth}) must ` +\n      `match input depth in filter (${filterShape[2]}).`);\n  util.assert(\n    outDepth === filterShape[3],\n    () => `Error in conv2dDerFilter: depth of dy (${outDepth}) must ` +\n      `match output depth for filter (${filterShape[3]}).`);\n  if (dimRoundingMode != null) {\n    util.assert(\n      util.isInt(pad as number),\n      () => `Error in conv2dDerFilter: pad must be an integer when using, ` +\n        `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n  }\n  const inputs: Conv2DBackpropFilterInputs = {x: x4D, dy: dy4D};\n  const attrs: Conv2DBackpropFilterAttrs = {\n    strides, pad, dataFormat, dimRoundingMode, filterShape;\n  };\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  return ENGINE.runKernel(\n    Conv2DBackpropFilter, inputs as {} as NamedTensorMap,\n    attrs as {} as NamedAttrMap) as Tensor4D;\n}\n\nexport const conv2DBackpropFilter = op({conv2DBackpropFilter_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,

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=====\n*\n\nimport {Tensor} from './tensor';\nimport * as broadcast_util from './broadcast_util';\nimport {elu} from './elu';\nimport {Activation} from './fused_types';\nimport {leakyRelu} from './leaky_relu';\nimport {mul} from './mul';\nimport {prelu} from './prelu';\nimport {relu} from './relu';\nimport {relu6} from './relu6';\nimport {reshape} from './reshape';\nimport {step} from './step';\nimport {sum} from './sum';\n\n// Returns gradient for fused activation.\nexport function getFusedDyActivation(\n  dy: Tensor, y: Tensor, activation: Activation): Tensor {\n  if (activation == null || activation === 'linear') {\n    return dy;\n  }\n  if (activation === 'relu') {\n    return mul(dy, step(y));\n  }\n  throw new Error(`Cannot compute gradient for fused activation ${activation}.`);\n}\n\n// Returns gradient for fused bias.\nexport function getFusedBiasGradient(\n  bias: Tensor, dyActivation: Tensor): Tensor {\n  let res = dyActivation;\n  const reduceAxes = broadcast_util.getReductionAxes(bias.shape, dyActivation.shape);\n  if (reduceAxes.length > 0) {\n    res = sum(res, reduceAxes);\n  }\n  return reshape(res, bias.shape);\n}\n\nexport function applyActivation(\n  x: Tensor, activation: Activation, preluActivationWeights?: Tensor,\n  leakyreluAlpha?: number): Tensor {\n  if (activation === 'linear') {\n    return x;\n  } else if (activation === 'relu') {\n    return relu(x);\n  } else if (activation === 'elu') {\n    return elu(x);\n  } else if (activation === 'relu6') {\n    return relu6(x);\n  } else if (activation === 'prelu') {\n    return prelu(x, preluActivationWeights);\n  } else if (activation === 'leakyrelu') {\n    return leakyRelu(x, leakyreluAlpha);\n  }\n  throw new Error(`Unknown fused activation ${activation}.`);\n}\n\n// Whether we should call fused ops.\nexport const shouldFuse = (gradientDepth: number, activation: Activation) => {\n  const gradientMode = gradientDepth > 0;\n  return !gradientMode || activation === 'linear';\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {ENGINE} from '../engine';\nimport {customGrad} from '../gradients';\nimport {FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D} from '../tensor';\nimport {GradSaveFunc, NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\nimport {add} from './add';\nimport * as broadcast_util from './broadcast_util';\nimport {conv2d as unfusedConv2d} from './conv2d';\nimport {conv2DBackpropFilter} from './conv2d_backprop_filter';\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport * as conv_util from './conv_util';\nimport {Activation} from './fused_types';\nimport {applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 2D convolution over the input x, optionally fused with adding a\n * bias and applying an activation.\n */\nexport function fusedConv2d(\n  const inputDepth = 2;\n  const inShape = [2, 2, 2, inputDepth];\n  const outputDepth = 2;\n  const fSize = 1;\n  const pad = 0;\n  const strides = 1;\n  const x = tf.tensor4d([1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16], inShape);\n  const w = tf.tensor4d([-1, 1, -2, 0.5], [fSize, fSize, inputDepth, outputDepth]);\n  const filter = w, strides, pad, dataFormat: 'NHWC',\n  dilations: [1, 1], bias: tf.scalar(5), activation: 'relu' }).print();\n\n@param obj An object with the following properties:\n * @param x The input tensor, of rank 4 or rank 3, of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n * @param filter The filter, rank 4, of shape
```

`[filterHeight, filterWidth, inDepth, outDepth]`.
 * `@param strides` The strides of the convolution: `[strideHeight, strideWidth]`.
 * `@param pad` The type of padding algorithm.
 * `- 'same'` and `stride 1`: output will be of same size as input, regardless of filter size.
 * `- 'valid'` output will be smaller than input if filter is larger than `1x1`.
 * - For more info, see this guide:

https://www.tensorflow.org/api_guides/python/nn#Convolution

`https://www.tensorflow.org/api_guides/python/nn#Convolution`
 * `@param dataFormat` An optional string from: `"NHWC"`, `"NCHW"`. Defaults to `"NHWC"`.

Specify the data format of the input and output data. With the default format `"NHWC"`, the data is stored in the order of: `[batch, height, width, channels]`. Only `"NHWC"` is currently supported.
 * `@param dilations` The dilation rates: `[dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.
 * `@param dimRoundingMode` A string from: `'ceil'`, `'round'`, `'floor'`. If none is provided, it will default to `truncate`.
 * `@param bias` Tensor to be added to the result.
 * `@param activation` Name of activation kernel (defaults to `'linear'`) to be applied after `biasAdd`.
 * `@param preluActivationWeights` Tensor of prelu weights to be applied as part of a `'prelu'` activation, typically

the same shape as `x`.
 * `@param leakyreluAlpha` Optional. Alpha to be applied as part of a `'leakyrelu'` activation.
 * `@function fusedConv2d`
`<T extends Tensor3D|Tensor4D>({\n x,\n filter,\n strides,\n pad,\n dataFormat = 'NHWC',\n dilations = [1, 1],\n dimRoundingMode,\n bias,\n activation = 'linear',\n preluActivationWeights,\n leakyreluAlpha\n }): {\n x: T|TensorLike,\n filter: Tensor4D|TensorLike,\n strides: [number, number]|number,\n pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat?: 'NHWC'|'NCHW',\n dilations?: [number, number]|number,\n dimRoundingMode?: 'floor'|'round'|'ceil',\n bias?: Tensor|TensorLike,\n activation?: Activation,\n preluActivationWeights?: Tensor,\n leakyreluAlpha?: number\n }): T {\n activation = activation || 'linear';\n if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {\n let result = unfusedConv2d(\n x, filter, strides, pad, dataFormat, dilations, dimRoundingMode);\n if (bias != null) {\n result = add(result, bias);\n }\n return applyActivation(\n result, activation, preluActivationWeights, leakyreluAlpha) as T;\n }\n const $x = convertToTensor(x, 'x', 'conv2d');\n const $filter = convertToTensor(filter, 'filter', 'conv2d');\n let $x4D = $x as Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n reshapedTo4D = true;\n $x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n util.assert($x4D.rank === 4, () => `Error in fused conv2d: input must be rank 4, but got rank ` + $x4D.rank`);\n util.assert($filter.rank === 4, () => `Error in fused conv2d: filter must be rank 4, but got rank ` + $filter.rank`);\n if (dimRoundingMode != null) {\n util.assert(util.isInt(pad as number), () => `Error in fused conv2d: pad must be an integer when using, ` + dimRoundingMode + ` but got pad ${pad}`);\n }\n util.assert($x4D.shape[3] === $filter.shape[2], () => `Error in conv2d: depth of input (${x4D.shape[3]}) must match ` + input depth for filter ${filter.shape[2]}`);\n util.assert(conv_util.eitherStridesOrDilationsAreOne(strides, dilations), () => `Error in conv2D: Either strides or dilations must be 1.` + `Got strides ${strides} and dilations ${dilations}`);\n util.assert(dataFormat === 'NHWC', () => `Error in conv2d: got dataFormat of ${dataFormat} but only NHWC is currently supported.`);\n const convInfo = conv_util.computeConv2DInfo($x4D.shape, $filter.shape, strides, dilations, pad, dimRoundingMode);\n let $bias: Tensor;\n if (bias != null) {\n $bias = convertToTensor(bias, 'bias', 'fused conv2d');\n [$bias] = makeTypesMatch($bias, $x);\n }\n broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, $bias.shape);\n }\n let $preluActivationWeights: Tensor;\n if (preluActivationWeights != null) {\n $preluActivationWeights = convertToTensor(\n preluActivationWeights, 'prelu weights', 'fused conv2d');\n }\n const grad = (dy: Tensor4D, saved: Tensor[]) => {\n const [$filter, $x4D, $y, $bias] = saved as [Tensor4D, Tensor4D, Tensor4D, Tensor];\n const dyActivation = getFusedDyActivation(dy, $y, activation) as Tensor4D;\n util.assert(\n`

except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {ENGINE} from './engine';\nimport  
{DepthwiseConv2dNativeBackpropInput, DepthwiseConv2dNativeBackpropInputAttrs,  
DepthwiseConv2dNativeBackpropInputInputs} from './kernel_names';\nimport {NamedAttrMap} from  
 './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from  
 './tensor_types';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nfunction  
depthwiseConv2dNativeBackpropInput_<T extends Tensor3D|Tensor4D>(\n  xShape: [number, number, number,  
number], dy: T, filter: Tensor4D,\n  strides: [number, number]|number, pad: 'valid'|'same'|number,\n  dilations:  
[number, number]|number = [1, 1],\n  dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  let dy4D = dy as  
Tensor4D;\n  let reshapedTo4D = false;\n  if (dy.rank === 3) {\n    reshapedTo4D = true;\n    dy4D = reshape(dy, [1,  
dy.shape[0], dy.shape[1], dy.shape[2]]);\n  }\n  const inputs: DepthwiseConv2dNativeBackpropInputInputs = {dy:  
dy4D, filter};\n  const attrs: DepthwiseConv2dNativeBackpropInputAttrs  
= {\n    strides, pad, dimRoundingMode, dilations, inputShape: xShape;\n  };\n  const res =\n    // tslint:disable-next-  
line: no-unnecessary-type-assertion\n    ENGINE.runKernel(\n      DepthwiseConv2dNativeBackpropInput,  
inputs as {} as NamedTensorMap,\n      attrs as {} as NamedAttrMap) as T;\n  if (reshapedTo4D) {\n    return  
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n  }\n  return res;\n}\nexport const  
depthwiseConv2dNativeBackpropInput =\n  op({depthwiseConv2dNativeBackpropInput_});\n"/**\n *  
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version  
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a  
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable  
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License  
for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './../engine';\nimport {customGrad} from './../gradients';\nimport  
{FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs} from  
 './../kernel_names';\nimport {NamedAttrMap} from './../kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D}  
from './../tensor';\nimport {GradSaveFunc, NamedTensorMap} from './../tensor_types';\nimport  
{makeTypesMatch} from './../tensor_util';\nimport {convertToTensor} from './../tensor_util_env';\nimport  
{TensorLike} from './../types';\nimport * as util from './../util';\nimport {add} from './add';\nimport * as  
broadcast_util from './broadcast_util';\nimport * as conv_util from './conv_util';\nimport {depthwiseConv2d as  
unfusedDepthwiseConv2d}  
from './depthwise_conv2d';\nimport {depthwiseConv2dNativeBackpropFilter} from  
 './depthwise_conv2d_native_backprop_filter';\nimport {depthwiseConv2dNativeBackpropInput} from  
 './depthwise_conv2d_native_backprop_input';\nimport {Activation} from './fused_types';\nimport  
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op}  
from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes depthwise 2D convolution, optionally  
fused with adding a\n * bias and applying an activation.\n *\n * Given a 4D `input` array and a `filter` array of  
shape\n * `[filterHeight, filterWidth, inChannels, channelMultiplier]` containing\n * `inChannels` convolutional  
filters of depth 1, this op applies a\n * different filter to each input channel (expanding from 1 channel to\n * `channelMultiplier`  
channels for each), then concatenates the results\n * together. The output has `inChannels`  
`channelMultiplier` channels.\n *\n */
```

* See https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d for more details.

@param obj An object with the following properties:

- x** The input tensor, of rank 4 or rank 3, of shape `[batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.
- filter** The filter tensor, rank 4, of shape `[filterHeight, filterWidth, inChannels, channelMultiplier]`.
- strides** The strides of the convolution: `[strideHeight, strideWidth]`. If strides is a single number, then `strideHeight == strideWidth`.
- pad** The type of padding algorithm. - `'same'` and stride 1: output will be of same size as input, regardless of filter size. - `'valid'`: output will be smaller than input if filter is larger than 1x1.
- For more info, see this guide: https://www.tensorflow.org/api_guides/python/nn#Convolution
- dilations** The dilation rates: `[dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.
- dataFormat**: An optional string from: `'NHWC'`, `'NCHW'`. Defaults to `'NHWC'`. Specify the data format of the input and output data. With the default format `'NHWC'`, the data is stored in the order of: [batch, height, width, channels]. Only `'NHWC'` is currently supported.
- dimRoundingMode** A string from: `'ceil'`, `'round'`, `'floor'`. If none is provided, it will default to `truncate`.
- bias** Tensor to be added to the result.
- activation** Name of activation kernel (defaults to `'linear'`).
- preluActivationWeights** Tensor of prelu weights to be applied as part of a `'prelu'` activation, typically the same shape as `x`.
- leakyreluAlpha** Optional. Alpha to be applied as part of a `'leakyrelu'` activation.

```

function fusedDepthwiseConv2d<T extends Tensor3D|Tensor4D>(
  {x: T|TensorLike, filter: Tensor4D|TensorLike,
  strides: [number, number]|number, pad: 'valid'|'same'|number,
  dataFormat?: 'NHWC'|'NCHW', dilations?: [number, number]|number,
  dimRoundingMode?: 'floor'|'round'|'ceil', bias?: Tensor|TensorLike,
  activation?: Activation, preluActivationWeights?: Tensor,
  leakyreluAlpha?: number}): T {
  if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {
    let result = unfusedDepthwiseConv2d(
      x,
      filter, strides, pad, dataFormat, dilations, dimRoundingMode);
    if (bias != null) {
      result = add(result, bias);
    }
    return applyActivation(result, activation, preluActivationWeights, leakyreluAlpha) as T;
  }
  const $x = convertToTensor(x, 'x', 'depthwiseConv2d');
  const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');
  let x4D = $x as Tensor4D;
  let reshapedTo4D = false;
  if ($x.rank === 3) {
    reshapedTo4D = true;
    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
  }
  util.assert(x4D.rank === 4, () => `Error in fused depthwiseConv2d: input must be rank 4, but got ` + rank($x4D.rank).`);
  util.assert($filter.rank === 4, () => `Error in fused depthwiseConv2d: filter must be rank 4, ` + `but got rank ${$filter.rank}.`);
  util.assert(x4D.shape[3] === $filter.shape[2], () => `Error in fused depthwiseConv2d: number of input channels ` + `(${x4D.shape[3]}) must match the inChannels dimension in ` + `filter ${$filter.shape[2]}.`);
  if (dilations == null) {
    dilations = [1, 1];
  }
  util.assert(conv_util.eitherStridesOrDilationsAreOne(strides, dilations), () => `Error in fused depthwiseConv2d: Either strides or dilations must ` + `be 1. Got strides ${strides} and dilations '${dilations}'`);
  if (dimRoundingMode != null) {
    util.assert(util.isInt(pad as number), () => `Error in fused depthwiseConv2d: pad must be an integer when ` + `using dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
  }
  const convInfo = conv_util.computeConv2DInfo(x4D.shape, $filter.shape, strides, dilations, pad, dimRoundingMode, true /* depthwise */);
  let $bias: Tensor;
  if (bias != null) {
    $bias = convertToTensor(bias, 'bias', 'fused conv2d');
    [$bias] = makeTypesMatch($bias, $x);
    broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, $bias.shape);
  }
  let $preluActivationWeights: Tensor;
  if (preluActivationWeights != null) {
    $preluActivationWeights =

```

```

convertToTensor(\n    preluActivationWeights, 'prelu weights', 'fused depthwiseConv2d');\n }\n\n const grad =
(dy: Tensor4D, saved: Tensor[]) => {\n    util.assert(\n        conv_util.tupleValuesAreOne(dilations),\n        () =>
'Error in gradient of fused depthwiseConv2d: dilation rates ' +\n        `greater than 1 are not yet supported. Got
dilations ` +\n        `${dilations}`);\n    const [filter, x4D, y, bias] = saved;\n\n    const dyActivation =
getFusedDyActivation(dy, y, activation) as Tensor4D;\n\n    const xDer = depthwiseConv2dNativeBackpropInput(\n
(x4D as Tensor4D).shape, dyActivation, $filter as Tensor4D, strides,\n    pad, dilations,
dimRoundingMode);\n    const filterDer = depthwiseConv2dNativeBackpropFilter(\n    x4D as Tensor4D,
dyActivation, ($filter
as Tensor4D).shape, strides,\n    pad, dilations, dimRoundingMode);\n\n    if (bias != null) {\n        const biasDer =
getFusedBiasGradient($bias, dyActivation);\n        return [xDer, filterDer, biasDer];\n    }\n    return [xDer,
filterDer];\n };\n\n const inputs: FusedDepthwiseConv2DInputs = {\n    x: x4D,\n    filter: $filter,\n    bias: $bias,\n    preluActivationWeights: $preluActivationWeights\n };\n\n const attrs: FusedDepthwiseConv2DAttrs = {\n
strides,\n    pad,\n    dataFormat,\n    dilations,\n    dimRoundingMode,\n    activation,\n    leakyreluAlpha\n };\n\n
// Depending on the the params passed in we will have different number of\n // inputs and thus a a different number
of elements in the gradient.\n if (bias == null) {\n    const customOp =\n        customGrad((x4D: Tensor4D, filter:
Tensor4D, save: GradSaveFunc) => {\n        // tslint:disable-next-line: no-unnecessary-type-assertion\n        let
res: Tensor4D|Tensor3D = ENGINE.runKernel(\n
            FusedDepthwiseConv2D, inputs as {} as NamedTensorMap,\n            attrs as {} as NamedAttrMap);\n\n
save([filter, x4D, res]);\n\n            if (reshapedTo4D) {\n                // tslint:disable-next-line: no-unnecessary-type-
assertion\n                res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n                Tensor3D;\n            }\n\n
            return {value: res, gradFunc: grad};\n        });\n        return customOp(x4D, $filter) as T;\n    } else {\n        const
customOpWithBias = customGrad(\n        (x4D: Tensor4D, filter: Tensor4D, bias: Tensor, save: GradSaveFunc) =>
{\n        // tslint:disable-next-line: no-unnecessary-type-assertion\n        let res: Tensor4D|Tensor3D =
ENGINE.runKernel(\n            FusedDepthwiseConv2D, inputs as {} as NamedTensorMap,\n            attrs as {} as
NamedAttrMap);\n\n        save([filter, x4D, res, bias]);\n\n        if (reshapedTo4D) {\n            // tslint:disable-next-
line: no-unnecessary-type-assertion\n            res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n            Tensor3D;\n        }\n\n
        return {value: res, gradFunc: grad};\n        });\n        return customOpWithBias(x4D, $filter, $bias) as T;\n
}\n}\n\nexport const depthwiseConv2d = op({fusedDepthwiseConv2d_});\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '././engine';\nimport {customGrad} from '././gradients';\nimport {_FusedMatMul,
_FusedMatMulAttrs, _FusedMatMulInputs} from '././kernel_names';\nimport {NamedAttrMap} from
'././kernel_registry';\nimport {Tensor, Tensor3D} from '././tensor';\nimport {GradSaveFunc, NamedTensorMap}
from '././tensor_types';\nimport {makeTypesMatch} from '././tensor_util';\nimport {convertToTensor} from
'././tensor_util_env';\nimport {TensorLike} from '././types';\nimport * as util from '././util';\nimport {add} from
'././add';\nimport * as broadcast_util from '././broadcast_util';\nimport {Activation} from '././fused_types';\nimport
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from '././fused_util';\nimport {matMul
as unfusedMatMul} from '././mat_mul';\nimport {op} from '././operation';\nimport {reshape} from
'././reshape';\n\n/**\n * Computes the dot product of two matrices with optional activation and
bias.\n *\n * `js` const a = tf.tensor2d([-1, -2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const
bias = tf.tensor2d([1, 2], [1, 2]);\n *\n * tf.fused.matMul({a, b, bias, activation: 'relu'}).print();\n *\n *\n * @param obj An object with the following properties:\n * - `a` First matrix in dot product operation.\n * - `b` Second

```

```

matrix in dot product operation.\n * - `transposeA` If true, `a` is transposed before multiplication.\n * - `transposeB`
If true, `b` is transposed before multiplication.\n * - `bias` Matrix to be added to the result.\n * - `activation` Name
of activation kernel (defaults to `linear`).\n * - `preluActivationWeights` Tensor of prelu weights.\n * -
`leakyreluAlpha` Alpha of leakyrelu.\n */\nfunction fusedMatMul<T extends Tensor>({\n  a,\n  b,\n  transposeA =
false,\n  transposeB = false,\n  bias,\n  activation = 'linear',\n  preluActivationWeights,\n  leakyreluAlpha,\n}): {\n  a:
T|TensorLike,\n  b: T|TensorLike,\n  transposeA?: boolean,\n  transposeB?: boolean,\n  bias?: Tensor|TensorLike,\n  activation?: Activation,\n  preluActivationWeights?:
Tensor\n  leakyreluAlpha?: number\n}): T {\n  if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {\n
  let result = unfusedMatMul(a, b, transposeA, transposeB);\n  if (bias != null) {\n    result = add(result,
bias);\n  }\n  return applyActivation(\n    result, activation, preluActivationWeights, leakyreluAlpha)
as\n    T;\n  }\n  let $a = convertToTensor(a, 'a', 'fused matMul');\n  let $b = convertToTensor(b, 'b', 'fused
matMul');\n  [$a, $b] = makeTypesMatch($a, $b);\n  const innerShapeA =\n    transposeA ? $a.shape[$a.rank
- 2] : $a.shape[$a.rank - 1];\n  const innerShapeB =\n    transposeB ? $b.shape[$b.rank - 1] : $b.shape[$b.rank
- 2];\n  const outerShapeA =\n    transposeA ? $a.shape[$a.rank - 1] : $a.shape[$a.rank - 2];\n  const
outerShapeB =\n    transposeB ? $b.shape[$b.rank
- 2] : $b.shape[$b.rank - 1];\n  const outerDimsA = $a.shape.slice(0, -2);\n  const outerDimsB =
$b.shape.slice(0, -2);\n  const batchDimA = util.sizeFromShape(outerDimsA);\n  const batchDimB =
util.sizeFromShape(outerDimsB);\n  util.assert(\n    $a.rank >= 2 && $b.rank >= 2 && $a.rank === $b.rank,\n
() => `Error in fused matMul: inputs must have the same rank of at ` +\n    `least 2, got ranks ${$a.rank}
and ${$b.rank}.`);\n  util.assert(\n    util.arraysEqual(outerDimsA, outerDimsB),\n    () => `Error in fused
matMul: outer dimensions (${outerDimsA}) and ` +\n    `${outerDimsB}) of Tensors with shapes ${$a.shape}
and ` +\n    `${$b.shape} must match.`);\n  util.assert(\n    innerShapeA === innerShapeB,\n    () =>
`Error in fused matMul: inner shapes (${innerShapeA}) and ` +\n    `${innerShapeB}) of Tensors with shapes
${$a.shape} and ` +\n    `${$b.shape} and transposeA=${transposeA}` +\n
    ` and transposeB=${transposeB} must match.`);\n  const outShape = $a.shape.slice(0, -
2).concat([outerShapeA, outerShapeB]);\n  const a3D: Tensor3D = transposeA ?\n    reshape($a, [batchDimA,
innerShapeA, outerShapeA]) :\n    reshape($a, [batchDimA, outerShapeA, innerShapeA]);\n  const b3D:
Tensor3D = transposeB ?\n    reshape($b, [batchDimB, outerShapeB, innerShapeB]) :\n    reshape($b,
[batchDimB, innerShapeB, outerShapeB]);\n  let $bias: Tensor;\n  if (bias != null) {\n    $bias =
convertToTensor(bias, 'bias', 'fused matMul');\n    [$bias] = makeTypesMatch($bias, $a);\n    broadcast_util.assertAndGetBroadcastShape(outShape, $bias.shape);\n  }\n  let $preluActivationWeights:
Tensor;\n  if (preluActivationWeights != null) {\n    $preluActivationWeights = convertToTensor(\n    preluActivationWeights, 'prelu weights', 'fused matMul');\n  }\n  const grad = (dy: Tensor3D, saved: Tensor[])
=> {\n    const [a3D, b3D,
y, $bias] = saved;\n    // we reshape dy because the result of the forward is not\n    // necessarily going to be a 3d
tensor due to a reshape done at the end of\n    // the customOp.\n    const dyActivation =\n    getFusedDyActivation(reshape(dy, y.shape), y, activation);\n    let aDer: Tensor;\n    let bDer: Tensor;\n    if
(!transposeA && !transposeB) {\n      aDer = unfusedMatMul(dyActivation, b3D, false, true);\n      bDer =
unfusedMatMul(a3D, dyActivation, true, false);\n    } else if (!transposeA && transposeB) {\n      aDer =
unfusedMatMul(dyActivation, b3D, false, false);\n      bDer = unfusedMatMul(dyActivation, a3D, true, false);\n
    } else if (transposeA && !transposeB) {\n      aDer = unfusedMatMul(b3D, dyActivation, false, true);\n      bDer =
unfusedMatMul(a3D, dyActivation, false, false);\n    } else {\n      aDer = unfusedMatMul(b3D, dyActivation,
true, true);\n      bDer = unfusedMatMul(dyActivation, a3D, true, true);\n    }\n    if (bias != null) {\n      const biasDer = getFusedBiasGradient($bias, dyActivation);\n      return [aDer,
bDer, biasDer];\n    } else {\n      return [aDer, bDer];\n    }\n  };}\n  const inputs: _FusedMatMulInputs = {\n
  a: a3D,\n  b: b3D,\n  bias: $bias,\n  preluActivationWeights: $preluActivationWeights\n  };\n  const
attrs: _FusedMatMulAttrs =\n    {transposeA, transposeB, activation, leakyreluAlpha};\n  // Depending on the
the params passed in we will have different number of\n  // inputs and thus a a different number of elements in the

```

```

gradient.\n  if (bias == null) {\n    const customOp =\n      customGrad((a3D: Tensor3D, b3D: Tensor3D, save:
GradSaveFunc) => {\n      const res =\n        // tslint:disable-next-line: no-unnecessary-type-assertion\n
ENGINE.runKernel(\n        _FusedMatMul, inputs as {} as NamedTensorMap,\n          attrs as {}
as NamedAttrMap) as
T;\n\n      save([a3D, b3D, res]);\n\n      return { value: reshape(res, outShape), gradFunc: grad};\n    });\n    return customOp(a3D, b3D) as T;\n  } else {\n    const customOpWithBias = customGrad(\n      (a3D:
Tensor3D, b3D: Tensor3D, $bias: Tensor, save: GradSaveFunc) => {\n      const res =\n        //
tslint:disable-next-line: no-unnecessary-type-assertion\n        ENGINE.runKernel(\n
_FusedMatMul, inputs as {} as NamedTensorMap,\n          attrs as {} as NamedAttrMap) as T;\n\n      save([a3D, b3D, res, $bias]);\n\n      return { value: reshape(res, outShape), gradFunc: grad};\n    });\n\n    return customOpWithBias(a3D, b3D, $bias) as T;\n  }\n}\n\nexport const matMul =
op({fusedMatMul_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {conv2d} from './fused/conv2d';\nimport {depthwiseConv2d} from
 './fused/depthwise_conv2d';\nimport {matMul} from './fused/mat_mul';\nimport {Activation} from
 './fused/types';\n\nexport {Activation, conv2d, depthwiseConv2d, matMul};\n", "/*\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may
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applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor1D} from '../tensor';\nimport {op} from './operation';\nimport {cosineWindow} from
 './signal_ops_util';\n\n/**\n * Generate a hamming window.\n *\n * See:
https://en.wikipedia.org/wiki/Window\_function#Hann\_and\_Hamming\_windows\n *\n * ``js\n *
tf.signal.hammingWindow(10).print();\n * ```\n * @param The length of window\n *\n * @doc {heading:
'Operations', subheading: 'Signal', namespace: 'signal'}\n\nfunction hammingWindow_(windowLength: number):
Tensor1D {\n  return
cosineWindow(windowLength, 0.54, 0.46);\n}\n\nexport const hammingWindow =
op({hammingWindow_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor1D} from '../tensor';\nimport {op} from './operation';\nimport {cosineWindow} from
 './signal_ops_util';\n\n/**\n * Generate a Hann window.\n *\n * See:
https://en.wikipedia.org/wiki/Window\_function#Hann\_and\_Hamming\_windows\n

```



```

*\n * ``js\n * tf.signal.hannWindow(10).print();\n * ``\n * @param The length of window\n * @doc {heading:
'Operations', subheading: 'Signal', namespace: 'signal'}\n *\nfunction hannWindow_(windowLength: number):
Tensor1D {\n return cosineWindow(windowLength, 0.5, 0.5);\n}\n\nexport const hannWindow =
op({hannWindow_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *

```

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=====
*\n\nimport {Tensor, Tensor1D} from '../tensor';\nimport {concat} from './concat';\nimport {fill} from
'./fill';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {slice} from './slice';\nimport
{tensor2d} from './tensor2d';\n\n/**\n * Expands input into frames of frameLength.\n * Slides a window size with
frameStep.\n * \n * ``js\n * tf.signal.frame([1, 2, 3], 2, 1).print();\n * ``\n * @param signal The input tensor to be
expanded\n * @param frameLength Length of each frame\n * @param frameStep The frame hop size in samples.\n *
@param padEnd Whether to pad the end of signal with padValue.\n * @param padValue An number to use where
the input signal does\n * not exist when padEnd is True.\n * \n * @doc {heading: 'Operations', subheading:
'Signal', namespace: 'signal'}\n *\nfunction frame_(\n signal: Tensor1D, frameLength:
number, frameStep: number, padEnd = false,\n padValue = 0): Tensor {\n let start = 0;\n const output: Tensor[]
= [];\n while (start + frameLength <= signal.size) {\n output.push(slice(signal, start, frameLength));\n start +=
frameStep;\n }\n\n if (padEnd) {\n while (start < signal.size) {\n const padLen = (start + frameLength) -
signal.size;\n const pad = concat([\n slice(signal, start, frameLength - padLen), fill([padLen], padValue)\n
]);\n output.push(pad);\n start += frameStep;\n }\n\n if (output.length === 0) {\n return tensor2d([],
[0, frameLength]);\n }\n\n return reshape(concat(output), [output.length, frameLength]);\n}\n\nexport const frame =
op({frame_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {Tensor, Tensor1D} from '../tensor';\nimport {concat} from './concat';\nimport {mul} from
'./mul';\nimport {op} from './operation';\nimport {enclosingPowerOfTwo} from './signal_ops_util';\nimport {slice}
from './slice';\nimport {rfft} from './spectral/rfft';\n\nimport {frame} from './frame';\nimport {hannWindow} from
'./hann_window';\n\n/**\n * Computes the Short-time Fourier Transform of signals\n * See:
https://en.wikipedia.org/wiki/Short-time_Fourier_transform\n * \n * ``js\n * const input = tf.tensor1d([1, 1,
1, 1, 1])\n * tf.signal.stft(input, 3, 1).print();\n * ``\n * @param signal 1-dimensional real value tensor.\n *
@param frameLength The window length of samples.\n * @param frameStep The number of samples to step.\n * @param
fftLength The size of the FFT to apply.\n * @param windowFn A callable that takes a window length and returns 1-
d tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}\n *\nfunction stft_(\n
signal: Tensor1D, frameLength: number, frameStep: number,\n fftLength?: number,\n windowFn: (length:
number) => Tensor1D = hannWindow): Tensor {\n if (fftLength == null) {\n fftLength =
enclosingPowerOfTwo(frameLength);\n }\n const framedSignal = frame(signal, frameLength, frameStep);\n const
windowedSignal = mul(framedSignal, windowFn(frameLength));\n const output: Tensor[] = [];\n for (let i = 0; i <
framedSignal.shape[0]; i++) {\n output.push(\n rfft(slice(windowedSignal, [i, 0], [1, frameLength]),
fftLength));\n }\n

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} \n return concat(output);\n}\nexport const stft = op({stft_});\n",/*\n * @license\n * Copyright 2020 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\n\nimport {ENGINE} from '../engine';\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs}\nfrom '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor1D, Tensor2D,\n Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}\nfrom '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\nimport {op}\nfrom './operation';\n\n/**\n * Extracts crops from the input image tensor and resizes them using bilinear\n * sampling or nearest neighbor sampling (possibly with aspect ratio change)\n * to a common output size specified by\n * cropSize.\n * \n * @param image 4d tensor of shape `[batch,imageHeight,imageWidth, depth]`,\n * where\n * imageHeight and imageWidth must be positive, specifying the\n * batch of images from which to take crops\n * \n * @param boxes 2d float32 tensor of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)`\n * and `(y2, x2)` are the normalized\n * coordinates of the box in the boxInd[i]'th image in the batch\n * \n * @param boxInd 1d int32 tensor of shape `[numBoxes]` with values in range\n * `[0, batch)`\n * that specifies the image that the `i`-th box refers to.\n * \n * @param cropSize 1d int32 tensor of 2 elements\n * `[cropHeight, cropWidth]`\n * specifying the size to which all crops are resized to.\n * \n * @param method Optional\n * string from `bilinear` | `nearest`,\n * defaults to bilinear, which specifies the sampling method for resizing\n * \n * @param extrapolationValue A threshold for deciding when to remove boxes based\n * on score. Defaults to 0.\n * \n * @return A 4D tensor of the shape `[numBoxes,cropHeight,cropWidth,depth]`\n * \n * @doc {heading: 'Operations',\n * subheading: 'Images', namespace: 'image'}\n */\nfunction cropAndResize_(\n image: Tensor4D|TensorLike,\n boxes: Tensor2D|TensorLike,\n boxInd: Tensor1D|TensorLike,\n cropSize: [number, number],\n method:\n 'bilinear'|'nearest' = 'bilinear',\n extrapolationValue = 0,\n ): Tensor4D {\n const $image =\n convertToTensor(image, 'image', 'cropAndResize');\n const $boxes = convertToTensor(boxes, 'boxes',\n 'cropAndResize',\n 'float32');\n const $boxInd = convertToTensor(boxInd, 'boxInd', 'cropAndResize', 'int32');\n\n const numBoxes =\n $boxes.shape[0];\n\n util.assert(\n $image.rank === 4,\n () => `Error in cropAndResize: image must be rank\n 4,` +\n `but got rank ${$image.rank}.`);\n util.assert(\n $boxes.rank === 2 && $boxes.shape[1] === 4,\n () => `Error in cropAndResize: boxes must be have size [${numBoxes},4]` +\n `but had shape\n ${$boxes.shape}.`);\n util.assert(\n $boxInd.rank === 1 && $boxInd.shape[0] === numBoxes,\n () => `Error\n in cropAndResize: boxInd must be have size [${numBoxes}]` +\n `but had shape ${$boxes.shape}.`);\n util.assert(\n cropSize.length === 2,\n () => `Error in cropAndResize: cropSize must be of length 2, but got`\n +\n `length ${cropSize.length}.`);\n util.assert(\n cropSize[0] >= 1 && cropSize[1] >= 1,\n () =>\n `cropSize must be atleast [1,1], but was ${cropSize}`);\n util.assert(\n method === 'bilinear' || method === 'nearest',\n () => `method must be bilinear or nearest, but was\n ${method}`);\n\n const inputs:\n CropAndResizeInputs = {image: $image, boxes: $boxes, boxInd: $boxInd};\n const attrs: CropAndResizeAttrs = {method, extrapolationValue, cropSize};\n const res = ENGINE.runKernel(\n CropAndResize, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n return res as\n Tensor4D;\n}\n\nexport const cropAndResize = op({cropAndResize_});\n",/*\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF
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```
=====\n\n*\n\nimport {ENGINE} from '././engine';\nimport {FlipLeftRight, FlipLeftRightInputs} from\n '././kernel_names';\nimport {Tensor4D} from '././tensor';\nimport {NamedTensorMap} from\n '././tensor_types';\nimport {convertToTensor} from '././tensor_util_env';\nimport {TensorLike} from\n '././types';\nimport * as util from '././util';\nimport {op} from '././operation';\n\n/**\n * Flips the image left to right.\n * Currently available in the CPU, WebGL, and\n * WASM backends.\n *\n * @param image 4d tensor of shape\n `[batch, imageHeight, imageWidth, depth]`\n *\n * @doc {heading: 'Operations', subheading: 'Images',\n namespace: 'image'}\n */\nfunction flipLeftRight_(image: Tensor4D|TensorLike): Tensor4D {\n  const $image =\n  convertToTensor(image, 'image', 'flipLeftRight',\n  'float32');\n  util.assert(\n    $image.rank === 4,\n    () => 'Error in flipLeftRight: image must be rank 4,' +\n    `but got rank ${$image.rank}.`);\n  const inputs: FlipLeftRightInputs = {image: $image};\n  const res =\n  ENGINE.runKernel(FlipLeftRight, inputs as {} as NamedTensorMap, {});\n  return res as Tensor4D;\n}\n\nexport\n  const flipLeftRight = op({flipLeftRight_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions\n * and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from '././engine';\nimport {RotateWithOffset, RotateWithOffsetAttrs,\n  RotateWithOffsetInputs} from '././kernel_names';\nimport {NamedAttrMap} from '././kernel_registry';\nimport\n {Tensor4D} from '././tensor';\nimport {NamedTensorMap} from '././tensor_types';\nimport {convertToTensor}\n from '././tensor_util_env';\nimport {TensorLike} from '././types';\nimport * as util from '././util';\nimport {op}\n from '././operation';\n\n/**\n * Rotates the input image tensor counter-clockwise with an optional offset\n * center of rotation. Currently available in the CPU, WebGL, and WASM backends.\n *\n * @param image 4d tensor of shape\n `[batch, imageHeight, imageWidth, depth]`\n *\n * @param radians The amount of rotation.\n *\n * @param fillValue The value to fill in the empty space leftover\n * after rotation. Can be either a single grayscale\n * value (0-255), or an\n * array of three numbers `[red, green, blue]` specifying the red, green,\n * and blue\n * channels. Defaults to `0` (black).\n *\n * @param center The center of rotation. Can be either a single value (0-1), or\n * an\n * array of two numbers `[centerX, centerY]`. Defaults to `0.5` (rotates\n * the image around its center).\n *\n * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\nfunction rotateWithOffset_(\n  image: Tensor4D|TensorLike, radians: number,\n  fillValue: number|[number, number, number] = 0,\n  center:\n  number|[number, number] = 0.5): Tensor4D {\n  const $image = convertToTensor(image, 'image',\n  'rotateWithOffset', 'float32');\n  util.assert(\n    $image.rank === 4,\n    () => 'Error in rotateWithOffset: image\n  must be rank 4,' +\n    `but got rank ${$image.rank}.`);\n  const inputs: RotateWithOffsetInputs = {image:\n  $image};\n  const attrs: RotateWithOffsetAttrs = {radians, fillValue, center};\n  const\n  res = ENGINE.runKernel(\n    RotateWithOffset, inputs as {} as NamedTensorMap,\n    attrs as {} as\n    NamedAttrMap);\n  return res as Tensor4D;\n}\n\nexport const rotateWithOffset =\n  op({rotateWithOffset_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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License.\n *

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=====\n
*\n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport * as util
from './util';\n\nfunction nonMaxSuppSanityCheck(\n  boxes: Tensor2D, scores: Tensor1D, maxOutputSize:
number,\n  iouThreshold: number, scoreThreshold: number, softNmsSigma?: number): {\n  maxOutputSize:
number,\n  iouThreshold: number,\n  scoreThreshold: number,\n  softNmsSigma: number\n} {\n  if (iouThreshold
== null) {\n    iouThreshold = 0.5;\n  }\n  if (scoreThreshold == null) {\n    scoreThreshold =
Number.NEGATIVE_INFINITY;\n  }\n  if (softNmsSigma == null) {\n    softNmsSigma = 0.0;\n  }\n\n  const
numBoxes = boxes.shape[0];\n  maxOutputSize = Math.min(maxOutputSize, numBoxes);\n\n  util.assert(\n    0 <=
iouThreshold && iouThreshold <= 1,\n    () => `iouThreshold must be in [0, 1], but was '${iouThreshold}`);\n
util.assert(\n    boxes.rank === 2,\n    () => `boxes must be a 2D tensor, but was of rank '${boxes.rank}`);\n
util.assert(\n    boxes.shape[1] === 4,\n    () =>\n      `boxes must have 4 columns, but 2nd dimension was
${boxes.shape[1]}`);\n
  util.assert(scores.rank === 1, () => 'scores must be a 1D tensor');\n  util.assert(\n    scores.shape[0] ===
numBoxes,\n    () => `scores has incompatible shape with boxes. Expected ${numBoxes}, `+\n      `but was
${scores.shape[0]}`);\n  util.assert(\n    0 <= softNmsSigma && softNmsSigma <= 1,\n    () => `softNmsSigma
must be in [0, 1], but was '${softNmsSigma}`);\n  return {maxOutputSize, iouThreshold, scoreThreshold,
softNmsSigma};\n}\n\nexport {nonMaxSuppSanityCheck};\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
```

```
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {NonMaxSuppressionV3} from './kernel_names';\nimport
{Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport {nonMaxSuppSanityCheck} from './nonmax_util';\nimport {op} from
 './operation';\n\n/**\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over
union).\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is\n *   `[y1, x1, y2, x2]`, where
`[y1, x1]` and `[y2, x2]` are the corners of\n *   the bounding box.\n * @param scores a 1d tensor providing the
box scores of shape `[numBoxes]`.\n * @param maxOutputSize The maximum number of boxes to be selected.\n *
@param iouThreshold\n *   A float representing the threshold for deciding whether\n *   boxes overlap too much with respect to IOU. Must be
between [0, 1].\n *   Defaults to 0.5 (50% box overlap).\n * @param scoreThreshold A threshold for deciding when
to remove boxes based\n *   on score. Defaults to -inf, which means any score is accepted.\n * @return A 1D
tensor with the selected box indices.\n *\n * @doc {heading: 'Operations', subheading: 'Images', namespace:
'image'}\n */\n\nfunction nonMaxSuppression_(\n  boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n  maxOutputSize: number, iouThreshold = 0.5,\n  scoreThreshold = Number.NEGATIVE_INFINITY): Tensor1D
{\n  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n  const $scores =
convertToTensor(scores, 'scores', 'nonMaxSuppression');\n  const inputs = nonMaxSuppSanityCheck(\n
    $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n  maxOutputSize = inputs.maxOutputSize;\n
  iouThreshold = inputs.iouThreshold;\n
  scoreThreshold = inputs.scoreThreshold;\n\n  const attrs = {maxOutputSize, iouThreshold, scoreThreshold};\n
  return ENGINE.runKernel(\n    NonMaxSuppressionV3, {boxes: $boxes, scores: $scores}, attrs);\n}\n\nexport
const nonMaxSuppression = op({nonMaxSuppression_});\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
```

file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\n\n/**\n * Inserts a value into a sorted array. This method allows duplicate, meaning it\n * allows inserting duplicate value, in which case, the element will be inserted\n * at the lowest index of the value.\n * @param arr The array to modify.\n * @param element The element to insert.\n * @param comparator Optional. If no comparator is specified, elements are\n * compared using array_util.defaultComparator, which is suitable for Strings\n * and Numbers in ascending arrays. If the array contains multiple instances of\n * the target value, the left-most instance will be returned. To provide a\n * comparator, it should take 2 arguments to compare and return a negative,\n * zero, or a positive number.\n */\nexport function binaryInsert<T>(\n  arr: T[], element: T, comparator?: (a: T, b: T) =>\n  number) {\n  const index = binarySearch(arr, element, comparator);\n  const insertionPoint = index < 0 ? -(index +\n  1) : index;\n  arr.splice(insertionPoint, 0, element);\n}\n\n/**\n * Searches the array for the target using binary search, returns the index\n * of the found element, or position to insert if element not found. If no\n * comparator is specified, elements are compared using array_\n * util.defaultComparator, which is suitable for Strings and Numbers in\n * ascending arrays. If the array contains multiple instances of the target\n * value, the left-most instance will be returned.\n * @param arr The array to be searched in.\n * @param target The target to be searched for.\n * @param comparator Should take 2 arguments to compare and return a negative,\n * zero, or a positive number.\n * @return Lowest index of the target value if found, otherwise the insertion\n * point where the target should be inserted, in the form of\n * (-insertionPoint - 1).\n */\nexport function binarySearch<T>(\n  arr: T[], target: T, comparator?: (a: T, b: T) => number) {\n  return\n  binarySearch_(arr, target, comparator || defaultComparator);\n}\n\n/**\n * Compares its two arguments for order.\n * @param a The first element to be compared.\n * @param b The second element to be compared.\n * @return A negative number, zero, or a positive number as the first\n * argument is less than, equal to, or greater than the second.\n */\nfunction defaultComparator<T>(a: T, b: T): number {\n  return a > b ? 1 : a < b\n  ? -1 : 0;\n}\n\nfunction binarySearch_<T>(\n  arr: T[], target: T, comparator: (a: T, b: T) => number) {\n  let left = 0;\n  let right = arr.length;\n  let middle = 0;\n  let found = false;\n  while (left < right) {\n    middle = left + ((right -\n    left) >>> 1);\n    const compareResult = comparator(target, arr[middle]);\n    if (compareResult > 0) {\n      left = middle + 1;\n    } else {\n      right = middle;\n      // If compareResult is 0, the value is found. We record it is\n      found, // and then keep looking because there may be duplicate.\n      found = !compareResult;\n    }\n  }\n  return found ? left : -left - 1;\n}\n\n", "*/\n * @license\n

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*\n\nimport {TypedArray} from '../types';\nimport {binaryInsert} from './non_max_suppression_util';\n\n/**\n * Implementation of the NonMaxSuppression kernel shared between webgl and cpu.\n */\ninterface Candidate {\n  score: number;\n  boxIndex: number;\n  suppressBeginIndex: number;\n}\n\ninterface\n  NonMaxSuppressionResult {\n  selectedIndices: number[];\n  selectedScores?: number[];\n  validOutputs?:\n  number;\n}\n\nexport function nonMaxSuppressionV3Impl(\n  boxes: TypedArray, scores: TypedArray,\n  maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number): NonMaxSuppressionResult {\n  return nonMaxSuppressionImpl_(\n    boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,\n    0 /*\n    softNmsSigma */);\n}\n\nexport function nonMaxSuppressionV4Impl(\n  boxes: TypedArray, scores: TypedArray,\n

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maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  padToMaxOutputSize: boolean):
NonMaxSuppressionResult {\n  return nonMaxSuppressionImpl_(\n    boxes, scores, maxOutputSize,
iouThreshold, scoreThreshold,\n    0 /* softNmsSigma */, false /* returnScoresTensor */,
padToMaxOutputSize /* padToMaxOutputSize */, true\n    /* returnValidOutputs */);\n}\n\nexport function
nonMaxSuppressionV5Impl(\n  boxes: TypedArray, scores:
TypedArray, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  softNmsSigma:
number): NonMaxSuppressionResult {\n  return nonMaxSuppressionImpl_(\n    boxes, scores, maxOutputSize,
iouThreshold, scoreThreshold, softNmsSigma,\n    true /* returnScoresTensor */);\n}\n\nfunction
nonMaxSuppressionImpl_(\n  boxes: TypedArray, scores: TypedArray, maxOutputSize: number,\n
iouThreshold: number, scoreThreshold: number, softNmsSigma: number,\n  returnScoresTensor = false,
padToMaxOutputSize = false,\n  returnValidOutputs = false): NonMaxSuppressionResult {\n  // The list is sorted
in ascending order, so that we can always pop the\n  // candidate with the largest score in O(1) time.\n  const
candidates = [];\n\n  for (let i = 0; i < scores.length; i++) {\n    if (scores[i] > scoreThreshold) {\n
candidates.push({score: scores[i], boxIndex: i, suppressBeginIndex: 0});\n    }\n  }\n\n  candidates.sort(ascendingComparator);\n\n  // If softNmsSigma is 0,
the outcome of this algorithm is exactly same as\n  // before.\n  const scale = softNmsSigma > 0 ? (-0.5 /
softNmsSigma) : 0.0;\n  const selectedIndices: number[] = [];\n  const selectedScores: number[] = [];\n\n  while
(selectedIndices.length < maxOutputSize && candidates.length > 0) {\n    const candidate = candidates.pop();\n
const {score: originalScore, boxIndex, suppressBeginIndex} = candidate;\n\n    if (originalScore < scoreThreshold)
{\n      break;\n    }\n\n    // Overlapping boxes are likely to have similar scores, therefore we\n    // iterate through
the previously selected boxes backwards in order to\n    // see if candidate's score should be suppressed. We use\n
// suppressBeginIndex to track and ensure a candidate can be suppressed\n    // by a selected box no more than once.
Also, if the overlap exceeds\n    // iouThreshold, we simply ignore the candidate.\n    let ignoreCandidate = false;\n
for (let j = selectedIndices.length - 1; j >= suppressBeginIndex; --j)
{\n      const iou = intersectionOverUnion(boxes, boxIndex, selectedIndices[j]);\n\n      if (iou >= iouThreshold) {\n
ignoreCandidate = true;\n      break;\n      }\n\n      candidate.score =\n        candidate.score *
suppressWeight(iouThreshold, scale, iou);\n\n      if (candidate.score <= scoreThreshold) {\n        break;\n      }\n
}\n\n    // At this point, if `candidate.score` has not dropped below\n    // `scoreThreshold`, then we know that we
went through all of the\n    // previous selections and can safely update `suppressBeginIndex` to the\n    // end of the
selected array. Then we can re-insert the candidate with\n    // the updated score and suppressBeginIndex back in the
candidate list.\n    // If on the other hand, `candidate.score` has dropped below the score\n    // threshold, we will not
add it back to the candidates list.\n    candidate.suppressBeginIndex = selectedIndices.length;\n\n    if
(!ignoreCandidate) {\n      // Candidate has passed all the
tests, and is not suppressed, so\n      // select the candidate.\n      if (candidate.score === originalScore) {\n
selectedIndices.push(boxIndex);\n      selectedScores.push(candidate.score);\n      } else if (candidate.score >
scoreThreshold) {\n      // Candidate's score is suppressed but is still high enough to be\n      // considered, so add
back to the candidates list.\n      binaryInsert(candidates, candidate, ascendingComparator);\n      }\n    }\n\n  }\n\n  //
NonMaxSuppressionV4 feature: padding output to maxOutputSize.\n  const validOutputs = selectedIndices.length;\n
const elemsToPad = maxOutputSize - validOutputs;\n\n  if (padToMaxOutputSize && elemsToPad > 0) {\n
selectedIndices.push(...new Array(elemsToPad).fill(0));\n    selectedScores.push(...new
Array(elemsToPad).fill(0.0));\n  }\n\n  const result: NonMaxSuppressionResult = {selectedIndices};\n\n  if
(returnScoresTensor) {\n    result['selectedScores'] = selectedScores;\n  }\n\n  if (returnValidOutputs)
{\n    result['validOutputs'] = validOutputs;\n  }\n\n  return result;\n}\n\nfunction intersectionOverUnion(boxes:
TypedArray, i: number, j: number) {\n  const iCoord = boxes.subarray(i * 4, i * 4 + 4);\n  const jCoord =
boxes.subarray(j * 4, j * 4 + 4);\n  const yminI = Math.min(iCoord[0], iCoord[2]);\n  const xminI =
Math.min(iCoord[1], iCoord[3]);\n  const ymaxI = Math.max(iCoord[0], iCoord[2]);\n  const xmaxI =
Math.max(iCoord[1], iCoord[3]);\n  const yminJ = Math.min(jCoord[0], jCoord[2]);\n  const xminJ =
Math.min(jCoord[1], jCoord[3]);\n  const ymaxJ = Math.max(jCoord[0], jCoord[2]);\n  const xmaxJ =

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Math.max(jCoord[1], jCoord[3]);\n const areaI = (ymaxI - yminI) * (xmaxI - xminI);\n const areaJ = (ymaxJ -
yminJ) * (xmaxJ - xminJ);\n if (areaI <= 0 || areaJ <= 0) {\n return 0.0;\n }\n const intersectionYmin =
Math.max(yminI, yminJ);\n const intersectionXmin = Math.max(xminI, xminJ);\n const intersectionYmax =
Math.min(ymaxI, ymaxJ);\n const intersectionXmax = Math.min(xmaxI,
xmaxJ);\n const intersectionArea = Math.max(intersectionYmax - intersectionYmin, 0.0) *\n
Math.max(intersectionXmax - intersectionXmin, 0.0);\n return intersectionArea / (areaI + areaJ -
intersectionArea);\n}\n\n// A Gaussian penalty function, this method always returns values in [0, 1].\n// The weight
is a function of similarity, the more overlap two boxes are, the\n// smaller the weight is, meaning highly overlapping
boxe will be significantly\n// penalized. On the other hand, a non-overlapping box will not be penalized.\nfunction
suppressWeight(iouThreshold: number, scale: number, iou: number) {\n const weight = Math.exp(scale * iou *
iou);\n return iou <= iouThreshold ? weight : 0.0;\n}\n\nfunction ascendingComparator(c1: Candidate, c2:
Candidate) {\n // For objects with same scores, we make the object with the larger index go\n // first. In an array
that pops from the end, this means that the object with\n // the smaller index will be popped first. This ensures
the same output as\n // the TensorFlow python version.\n return (c1.score - c2.score) ||\n ((c1.score ===
c2.score) && (c2.boxIndex - c1.boxIndex));\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {nonMaxSuppressionV3Impl} from '../backends/non_max_suppression_impl';\nimport {Tensor1D,
Tensor2D}
from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport {nonMaxSuppSanityCheck} from '../nonmax_util';\nimport {tensor1d} from
'../tensor1d';\n\n/**\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over
union).\n * This is the async version of `nonMaxSuppression`\n * @param boxes a 2d tensor of shape
`[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n * the
bounding box.\n * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.\n * @param
maxOutputSize The maximum number of boxes to be selected.\n * @param iouThreshold A float representing the
threshold for deciding whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n *
Defaults to 0.5 (50% box overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes
based\n * on score. Defaults
to -inf, which means any score is accepted.\n * @return A 1D tensor with the selected box indices.\n *\n * @doc
{heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\n\nfunction
nonMaxSuppressionAsync_(\n boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n maxOutputSize:
number, iouThreshold = 0.5,\n scoreThreshold = Number.NEGATIVE_INFINITY): Promise<Tensor1D> {\n
const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n const $scores =
convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');\n\n const inputs = nonMaxSuppSanityCheck(\n
$boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n maxOutputSize = inputs.maxOutputSize;\n
iouThreshold = inputs.iouThreshold;\n scoreThreshold = inputs.scoreThreshold;\n\n const boxesAndScores = await
Promise.all([$boxes.data(), $scores.data()]);\n const boxesVals = boxesAndScores[0];\n const scoresVals =
boxesAndScores[1];\n\n // We call a cpu based impl directly
with the typedarray data here rather\n // than a kernel because all kernels are synchronous (and thus cannot await\n
// .data()).\n const {selectedIndices} = nonMaxSuppressionV3Impl(\n boxesVals, scoresVals, maxOutputSize,
iouThreshold, scoreThreshold);\n if ($boxes !== boxes) {\n $boxes.dispose();\n }\n if ($scores !== scores) {\n
$scores.dispose();\n }\n\n return tensor1d(selectedIndices, 'int32');\n}\n\nexport const nonMaxSuppressionAsync =

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nonMaxSuppressionAsync_;\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {ENGINE} from '../engine';\nimport {NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor, Tensor1D, Tensor2D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {nonMaxSupSanityCheck} from './nonmax_util';\nimport {op} from './operation';\n\n/**\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over union).\n * This op also supports a Soft-NMS mode (c.f.\n * Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the score\n * of other overlapping boxes, therefore favoring different regions of the image\n * with high scores. To enable this Soft-NMS mode, set the\n * `softNmsSigma`\n * parameter to be larger than 0.\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`.\n * Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n * the bounding box.\n * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.\n * @param maxOutputSize The maximum number of boxes to be selected.\n * @param iouThreshold A float representing the threshold for deciding whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n * Defaults to 0.5 (50% box overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes based\n * on score. Defaults to -inf, which means any score is accepted.\n * @param softNmsSigma A float representing the sigma parameter for Soft NMS.\n * When sigma is 0, it falls back to nonMaxSuppression.\n * @return A map with the following\n * properties:\n * - selectedIndices: A 1D tensor with the selected box indices.\n * - selectedScores: A 1D tensor with the corresponding scores for each\n * selected box.\n * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\nfunction nonMaxSuppressionWithScore_(\n  boxes: Tensor2D|TensorLike,\n  scores: Tensor1D|TensorLike,\n  maxOutputSize: number, iouThreshold = 0.5,\n  scoreThreshold = Number.NEGATIVE_INFINITY,\n  softNmsSigma = 0.0): NamedTensorMap {\n  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n  const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');\n  const params = nonMaxSupSanityCheck(\n    $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n  maxOutputSize = params.maxOutputSize;\n  iouThreshold = params.iouThreshold;\n  scoreThreshold = params.scoreThreshold;\n  softNmsSigma = params.softNmsSigma;\n  const inputs: NonMaxSuppressionV5Inputs\n    = {boxes: $boxes, scores: $scores};\n  const attrs: NonMaxSuppressionV5Attrs =\n    {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma};\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  const result = ENGINE.runKernel(\n    NonMaxSuppressionV5, inputs as {} as NamedTensorMap,\n    attrs as {} as NamedAttrMap) as Tensor[];\n  return {selectedIndices: result[0], selectedScores:\n    result[1]};\n}\n\nexport const nonMaxSuppressionWithScore = op({nonMaxSuppressionWithScore_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT

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* Asynchronously performs
non maximum suppression of bounding boxes based on
* iou (intersection over union), with an option to pad
results.
* @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is
* `[y1, x1, y2, x2]`, where
* `(y1, x1)` and `(y2, x2)` are the corners of
* the bounding box.
* @param scores a 1d tensor providing the box scores
of shape `[numBoxes]`.
* @param maxOutputSize The maximum number of boxes to be selected.
* @param iouThreshold A float representing the threshold for deciding whether
* boxes overlap too much with respect to IOU. Must be between [0, 1].
* Defaults to 0.5 (50% box overlap).
* @param scoreThreshold A threshold for deciding when to remove boxes based
* on score. Defaults to -inf, which means any score is accepted.
* @param padToMaxOutputSize Defaults to false. If true, size of output
* `selectedIndices` is padded to maxOutputSize.
* @return A map with the following properties:
* - selectedIndices: A 1D
tensor with the selected box indices.
* - validOutputs: A scalar denoting how many elements in
`selectedIndices`
* are valid. Valid elements occur first, then padding.
* @doc {heading: 'Operations',
subheading: 'Images', namespace: 'image'}
*/
function nonMaxSuppressionPadded_(
boxes:
Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
maxOutputSize: number, iouThreshold = 0.5,
scoreThreshold = Number.NEGATIVE_INFINITY,
padToMaxOutputSize = false): NamedTensorMap {
const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');
const $scores = convertToTensor(scores,
'scores', 'nonMaxSuppression');
const params = nonMaxSuppSanityCheck(
$boxes, $scores,
maxOutputSize, iouThreshold, scoreThreshold,
null /* softNmsSigma */);
const $maxOutputSize =
params.maxOutputSize;
const $iouThreshold = params.iouThreshold;
const $scoreThreshold =
params.scoreThreshold;
const inputs: NonMaxSuppressionV4Inputs = {boxes:
$boxes, scores: $scores};
const attrs: NonMaxSuppressionV4Attrs = {
maxOutputSize: $maxOutputSize,
iouThreshold: $iouThreshold,
scoreThreshold: $scoreThreshold,
padToMaxOutputSize
};
//
tslint:disable-next-line: no-unnecessary-type-assertion
const result = ENGINE.runKernel(
NonMaxSuppressionV4, inputs as {} as NamedTensorMap,
attrs as {} as NamedAttrMap) as
Tensor[];
return {selectedIndices: result[0], validOutputs: result[1]};
}
export const
nonMaxSuppressionPadded = op({nonMaxSuppressionPadded_});
*/
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*
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the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.
* See the License for the specific language governing permissions and
* limitations under the License.
*
=====
*/
import {nonMaxSuppressionV4Impl} from '../backends/non_max_suppression_impl';
import {Tensor1D,
Tensor2D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor}
from '../tensor_util_env';
import {TensorLike} from '../types';
import {nonMaxSuppSanityCheck} from
'../nonmax_util';
import {scalar} from '../scalar';
import {tensor1d} from '../tensor1d';
*/
**
* Asynchronously
performs non maximum suppression of bounding boxes based on
* iou (intersection over union), with an option to
pad results.
* @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is
* `[y1, x1, y2, x2]`,
where `(y1, x1)`
and `(y2, x2)` are the corners of
* the bounding box.
* @param scores a 1d tensor providing the box scores
of shape `[numBoxes]`.
* @param maxOutputSize The maximum number of boxes to be selected.
* @param
iouThreshold A float representing the threshold for deciding whether
* boxes overlap too much with respect to IOU. Must be between [0, 1].
* Defaults to 0.5 (50% box overlap).
* @param scoreThreshold A threshold for
deciding when to remove boxes based
* on score. Defaults to -inf, which means any score is accepted.
* @param
padToMaxOutputSize Defaults to false. If true, size of output
* `selectedIndices` is padded to
maxOutputSize.
* @return A map with the following properties:
* - selectedIndices: A 1D tensor with the

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selected box indices.\n * - validOutputs: A scalar denoting how many elements in `selectedIndices`\n * are
valid. Valid elements occur first, then padding.\n *\n * @doc {heading: 'Operations', subheading: 'Images',
namespace: 'image'}\n */\n\nfunction nonMaxSuppressionPaddedAsync_(\n boxes: Tensor2D|TensorLike,\n scores: Tensor1D|TensorLike,\n maxOutputSize: number, iouThreshold = 0.5,\n scoreThreshold =
Number.NEGATIVE_INFINITY,\n padToMaxOutputSize = false): Promise<NamedTensorMap> {\n const
$boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n const $scores = convertToTensor(scores,\n 'scores', 'nonMaxSuppressionAsync');\n\n const params = nonMaxSuppSanityCheck(\n $boxes, $scores,\n maxOutputSize, iouThreshold, scoreThreshold,\n null /* softNmsSigma */);\n const $maxOutputSize =
params.maxOutputSize;\n const $iouThreshold = params.iouThreshold;\n const $scoreThreshold =
params.scoreThreshold;\n\n const [boxesVals, scoresVals] =\n await Promise.all([$boxes.data(),\n $scores.data()]);\n\n // We call a cpu based impl directly with the typedarray data here rather\n // than a kernel
because all kernels are synchronous (and thus cannot await\n //
.data()).\n const {selectedIndices, validOutputs} = nonMaxSuppressionV4Impl(\n boxesVals, scoresVals,\n $maxOutputSize, $iouThreshold, $scoreThreshold,\n padToMaxOutputSize);\n\n if ($boxes !== boxes) {\n
$boxes.dispose();\n }\n if ($scores !== scores) {\n $scores.dispose();\n }\n\n return {\n selectedIndices:
tensor1d(selectedIndices, 'int32'),\n validOutputs: scalar(validOutputs, 'int32')\n };\n\n\nexport const
nonMaxSuppressionPaddedAsync = nonMaxSuppressionPaddedAsync_;\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS

```

OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

=====\n
*/\n\nimport {ENGINE} from '../engine';\nimport {ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs}
from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D, Tensor4D}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from
 '../operation';\nimport {reshape} from '../reshape';\n\n/**\n * Bilinear resize a single 3D image or a batch of 3D
images to a new shape.\n *\n * @param images The images, of rank 4 or rank 3, of shape\n * `[batch, height,
width, inChannels]`. If rank 3, batch of 1 is assumed.\n * @param size The new shape `[newHeight,
newWidth]` to resize the\n * images to. Each channel is resized individually.\n * @param alignCorners Defaults
to `false`. If true, rescale\n * input by `(new_height - 1) / (height - 1)`, which exactly aligns the 4\n *
corners of images and resized images. If false, rescale by\n * `new_height / height`. Treat similarly the width dimension.\n *
@param halfPixelCenters Defaults to `false`. Whether to assume pixel centers\n * are at 0.5, which would make
the floating point coordinates of the top\n * left pixel 0.5, 0.5.\n *\n * @doc {heading: 'Operations', subheading:
'Images', namespace: 'image'}\n */\n\nfunction resizeBilinear_<T extends Tensor3D|Tensor4D>(\n images:
T|TensorLike, size: [number, number], alignCorners = false,\n halfPixelCenters = false): T {\n const $images =
convertToTensor(images, 'images', 'resizeBilinear');\n\n util.assert(\n $images.rank === 3 || $images.rank ===
4,\n () => `Error in resizeBilinear: x must be rank 3 or 4,
but got `+\n `rank ${$images.rank}.`);\n util.assert(\n size.length === 2,\n () => `Error in
resizeBilinear: new shape must 2D, but got shape `+\n `${size}.`);\n util.assert(\n halfPixelCenters ===
false || alignCorners === false,\n () => `Error in resizeBilinear: If halfPixelCenters is true, `+\n
`alignCorners must be false.`);\n\n let batchImages = $images as Tensor4D;\n let reshapedTo4D = false;\n if
($images.rank === 3) {\n reshapedTo4D = true;\n batchImages = reshape(\n $images, [1, $images.shape[0],
$images.shape[1], $images.shape[2]]);\n }\n\n const [] = size;\n\n const inputs: ResizeBilinearInputs = {images:
batchImages};\n const attrs: ResizeBilinearAttrs = {alignCorners, halfPixelCenters, size};\n\n // tslint:disable-next-

```

```

line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n          ResizeBilinear, inputs as { } as
NamedTensorMap,\n          attrs as { } as NamedAttrMap) as
T;\n\n if (reshapedTo4D) {\n   return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n } \n return
res;\n}\n\nexport const resizeBilinear = op({resizeBilinear_});\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {ENGINE} from '../engine';\nimport {ResizeNearestNeighbor, ResizeNearestNeighborAttrs,
ResizeNearestNeighborInputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport * as util from '../util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * NearestNeighbor resize a batch of 3D images to a new shape.\n * @param images The
images, of rank 4 or rank 3, of shape\n *   [batch, height, width, inChannels] . If rank 3, batch of 1 is assumed.\n *
@param size The new shape [newHeight, newWidth] to resize the\n *   images to. Each channel is resized
individually.\n * @param alignCorners Defaults to False. If true, rescale\n *   input by (new_height - 1) / (height -
1), which exactly aligns the 4\n *   corners of images and resized images. If false, rescale by\n *   new_height /
height`.\n * @param halfPixelCenters Defaults to `false`. Whether to assume pixels
are of\n *   half the actual dimensions, and yields more accurate resizes. This flag\n *   would also make the
floating point coordinates of the top left pixel\n *   0.5, 0.5.\n * @doc {heading: 'Operations', subheading:
'Images', namespace: 'image'}\n */\nfunction resizeNearestNeighbor_<T extends Tensor3D|Tensor4D>(\n  images:
T|TensorLike, size: [number, number], alignCorners = false,\n  halfPixelCenters = false): T {\n  const $images =
convertToTensor(images, 'images', 'resizeNearestNeighbor');\n  util.assert(\n    $images.rank === 3 ||
$images.rank === 4,\n    () => `Error in resizeNearestNeighbor: x must be rank 3 or 4, but got ` +\n      `rank
${$images.rank}.`);\n  util.assert(\n    size.length === 2,\n    () =>\n      `Error in resizeNearestNeighbor: new
shape must 2D, but got shape ` +\n      `${size}.`);\n  util.assert(\n    $images.dtype === 'float32' || $images.dtype === 'int32',\n    () => `images` must have `int32` or `float32` as
dtype`);\n  util.assert(\n    halfPixelCenters === false || alignCorners === false,\n    () => `Error in
resizeNearestNeighbor: If halfPixelCenters is true, ` +\n      `alignCorners must be false.`);\n  let batchImages =
$images as Tensor4D;\n  let reshapedTo4D = false;\n  if ($images.rank === 3) {\n    reshapedTo4D = true;\n    batchImages = reshape(\n      $images, [1, $images.shape[0], $images.shape[1], $images.shape[2]]);\n  }\n  const []
= size;\n  const inputs: ResizeNearestNeighborInputs = {images: batchImages};\n  const attrs:\n  ResizeNearestNeighborAttrs = {alignCorners, halfPixelCenters, size};\n  // tslint:disable-next-line: no-
unnecessary-type-assertion\n  const res = ENGINE.runKernel(\n          ResizeNearestNeighbor, inputs as { } as
NamedTensorMap,\n          attrs as { } as NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n
return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n } \n return res;\n}\n\nexport const
resizeNearestNeighbor = op({resizeNearestNeighbor_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {Tensor} from '././tensor';\nimport {convertToTensor} from '././tensor_util_env';\nimport
{TensorLike}
from '././types';\nimport {assert} from '././util';\n\nimport {greaterEqual} from '././greater_equal';\nimport
{lessEqual} from '././less_equal';\nimport {logicalAnd} from '././logical_and';\nimport {op} from
'././operation';\nimport {range} from '././range';\nimport {reshape} from '././reshape';\nimport {scalar} from
'././scalar';\nimport {stack} from '././stack';\nimport {sub} from '././sub';\nimport {unstack} from '././unstack';\nimport
{where} from '././where';\nimport {zeros} from '././zeros';\n\n**\n * Copy a tensor setting everything outside a
central band in each innermost\n * matrix to zero.\n *\n * The band part is computed as follows: Assume input has
`k` dimensions\n * `[I, J, K, ..., M, N]`, then the output is a tensor with the same shape where\n * `band[i, j, k, ..., m,
n] = in_band(m, n) * input[i, j, k, ..., m, n]`.\n *\n * The indicator function\n * `in_band(m, n) = (num_lower < 0 || (m-n)
<= num_lower)`\n * `&& (num_upper < 0 || (n-m) <= num_upper)`\n *\n * ```\n *
const x = tf.tensor2d([[ 0, 1, 2, 3],\n *                    [-1, 0, 1, 2],\n *                    [-2, -1, 0, 1],\n *
[-3, -2, -1, 0]]);\n * let y = tf.linalg.bandPart(x, 1, -1);\n * y.print(); // [[ 0, 1, 2, 3],\n *          // [-1, 0, 1, 2],\n *
// [ 0, -1, 0, 1],\n *          // [ 0, 0, -1, 0]]\n * let z = tf.linalg.bandPart(x, 2, 1);\n * z.print(); // [[ 0, 1, 0, 0],\n *
// [-1, 0, 1, 0],\n *          // [-2, -1, 0, 1],\n *          // [ 0, -2, -1, 0]]\n * ```\n *\n * @param x Rank `k`
tensor\n * @param numLower Number of subdiagonals to keep.\n * If negative, keep entire lower triangle.\n *
@param numUpper Number of subdiagonals to keep.\n * If negative, keep entire upper triangle.\n * @returns
Rank `k` tensor of the same shape as input.\n * The extracted banded tensor.\n *\n * @doc {heading:'Operations',
subheading:'Linear Algebra', namespace:'linalg'}\n *\nfunction bandPart_<T extends Tensor>(\n
  a: T|TensorLike, numLower: number, numUpper: number): T {\n  assert(\n    numLower % 1 === 0,\n    () =>
`bandPart(): numLower must be an integer, got ${numLower}.`);\n  assert(\n    numUpper % 1 === 0,\n    () =>
`bandPart(): numUpper must be an integer, got ${numUpper}.`);\n\n  const $a = convertToTensor(a, 'a',
'bandPart');\n\n  assert(\n    $a.rank >= 2,\n    () => `bandPart(): Rank must be at least 2, got ${$a.rank}.`);\n\n
const shape = $a.shape;\n  const [M, N] = $a.shape.slice(-2);\n\n  if (!(numLower <= M)) {\n    throw new Error(\n
    `bandPart(): numLower (${numLower})` +\n    ` must not be greater than the number of rows (${M}).`);\n  }\n
if (!(numUpper <= N)) {\n    throw new Error(\n    `bandPart(): numUpper (${numUpper})` +\n    ` must not be
greater than the number of columns (${N}).`);\n  }\n\n  if (numLower < 0) {\n    numLower = M;\n  }\n  if
(numUpper < 0) {\n    numUpper = N;\n  }\n\n  const i = reshape(range(0, M, 1, 'int32'),
[-1, 1]);\n  const j = range(0, N, 1, 'int32');\n  const ij = sub(i, j);\n\n  const inBand = logicalAnd(\n    lessEqual(ij,
scalar(+numLower, 'int32')),\n    greaterEqual(ij, scalar(-numUpper, 'int32')));\n\n  const zero = zeros([M, N],
$a.dtype);\n\n  return reshape(\n    stack(unstack(reshape($a, [-1, M, N]))\n    .map(mat =>
where(inBand, mat, zero))),\n    shape) as T;\n}\n\nexport const bandPart = op({bandPart_});\n\n**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '././engine';\nimport {Tensor1D, Tensor2D} from '././tensor';\nimport {assert} from
'././util';\n\nimport {div} from '././div';\nimport {mul} from '././mul';\nimport {norm} from '././norm';\nimport {op}
from '././operation';\nimport {split} from '././split';\nimport {squeeze} from '././squeeze';\nimport {stack} from
'././stack';\nimport {sub} from '././sub';\nimport {sum} from '././sum';\n\n**\n * Gram-Schmidt orthogonalization.\n *\n *
```\n *
const x = tf.tensor2d([[1, 2], [3, 4]]);\n * let y = tf.linalg.gramSchmidt(x);\n * y.print();\n *
console.log('Orthogonalized:');\n * y.dot(y.transpose()).print(); // should be nearly the identity matrix.\n *
console.log('First row direction maintained:');\n * const data = await y.array();\n * console.log(data[0][1] /
data[0][0]);

```

```

// should be nearly 2.\n * ``\n * \n * @param xs The vectors to be orthogonalized, in one of the two following\n *
formats:\n * - An Array of `tf.Tensor1D`.\n * - A `tf.Tensor2D`, i.e., a matrix, in which case the vectors are the
rows\n * of `xs`.\n * In each case, all the vectors must have the same length and the length\n * must be greater
than or equal to the number of vectors.\n * @returns The orthogonalized and normalized vectors or matrix.\n *
Orthogonalization means that the vectors or the rows of the matrix\n * are orthogonal (zero inner products).
Normalization means that each\n * vector or each row of the matrix has an L2 norm that equals `1`.\n * \n * @doc
{heading:'Operations', subheading:'Linear Algebra', namespace:'linalg'}\n */\nfunction gramSchmidt_(xs:
Tensor1D[]|Tensor2D): Tensor1D[]|Tensor2D {\n let inputIsTensor2D: boolean;\n if (Array.isArray(xs)) {\n
inputIsTensor2D = false;\n assert(\n xs != null && xs.length > 0,\n () => 'Gram-Schmidt
process: input must not be null, undefined, or '+\n 'empty');\n const dim = xs[0].shape[0];\n for (let i = 1;
i < xs.length; ++i) {\n assert(\n xs[i].shape[0] === dim,\n () =>\n 'Gram-Schmidt: Non-unique
lengths found in the input vectors: '+\n `(${xs as Tensor1D[]}[i].shape[0]) vs. ${dim}`);\n }\n } else {\n
inputIsTensor2D = true;\n xs = split(xs, xs.shape[0], 0).map(x => squeeze(x, [0]));\n }\n\n assert(\n xs.length
<= xs[0].shape[0],\n () => `Gram-Schmidt: Number of vectors (${xs as Tensor1D[]}.length)\n
exceeds `+\n `number of dimensions (${xs as Tensor1D[]}[0].shape[0]).`);\n\n const ys: Tensor1D[] = [];\n
const xs1d = xs;\n for (let i = 0; i < xs.length; ++i) {\n ys.push(ENGINE.tidy(() => {\n let x = xs1d[i];\n if
(i > 0) {\n for (let j = 0; j < i; ++j) {\n const proj = mul(sum(mul(ys[j], x)), ys[j]);\n x
= sub(x, proj);\n }\n }\n return div(x, norm(x, 'euclidean')));\n }});\n }\n\n if (inputIsTensor2D) {\n
return stack(ys, 0) as Tensor2D;\n } else {\n return ys;\n }\n}\n\nexport const gramSchmidt =
op({gramSchmidt_});\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\nimport {ENGINE} from '../engine';\nimport
{dispose} from '../globals';\nimport {Tensor, Tensor2D} from '../tensor';\nimport {assert} from
'../util';\nimport {clone} from '../clone';\nimport {concat} from '../concat';\nimport {div} from '../div';\nimport
{eye} from '../eye';\nimport {greater} from '../greater';\nimport {matMul} from '../mat_mul';\nimport {mul} from
'../mul';\nimport {neg} from '../neg';\nimport {norm} from '../norm';\nimport {op} from '../operation';\nimport
{reshape} from '../reshape';\nimport {slice} from '../slice';\nimport {stack} from '../stack';\nimport {sub} from
'../sub';\nimport {tensor2d} from '../tensor2d';\nimport {transpose} from '../transpose';\nimport {unstack} from
'../unstack';\nimport {where} from '../where';\n\n/**\n * Compute QR decomposition of m-by-n matrix using
Householder transformation.\n * \n * Implementation based on\n *
[http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf]\n *
(http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf)\n * \n
* ```\n * const a = tf.tensor2d([[1, 2], [3, 4]]);\n * let [q, r] = tf.linalg.qr(a);\n * console.log('Q');\n * q.print();\n *
console.log('R');\n * r.print();\n * console.log('Orthogonalized');\n * q.dot(q.transpose()).print() // should be nearly
the identity matrix.\n * console.log('Reconstructed');\n * q.dot(r).print(); // should be nearly [[1, 2], [3, 4]];\n * ```\n
* \n * @param x The `tf.Tensor` to be QR-decomposed. Must have rank >= 2. Suppose\n * it has the shape `[..., M,
N]`.\n * @param fullMatrices An optional boolean parameter. Defaults to `false`.\n * If `true`, compute full-sized
`Q`. If `false` (the default),\n * compute only the leading N columns of `Q` and `R`.\n * @returns An `Array` of
two `tf.Tensor`s: `[Q, R]`. `Q` is a unitary matrix,\n * i.e., its columns all have unit norm and are mutually
orthogonal.\n * If `M >= N`,\n * If `fullMatrices` is `false` (default),\n * - `Q` has a shape of `[..., M, N]`,\n *
- `R` has a shape of `[..., N,`

```

```

N]`.\n * If `fullMatrices` is `true` (default),\n * - `Q` has a shape of `[..., M, M]`,\n * - `R` has a shape of
`[..., M, N]`.\n * If `M < N`,\n * - `Q` has a shape of `[..., M, M]`,\n * - `R` has a shape of `[..., M, N]`.\n *
@throws If the rank of `x` is less than 2.\n * @doc {heading:'Operations',\n * subheading:'Linear Algebra',\n
* namespace:'linalg'}\n * ^\nfunction qr_(x: Tensor, fullMatrices = false): [Tensor, Tensor] {\n assert(\n
x.rank >= 2,\n () => `qr` requires input tensor to have a rank >= 2, but got rank ${\n x.rank}`);\n\n if
(x.rank === 2)\n return qr2d(x as Tensor2D, fullMatrices);\n } else {\n // Rank > 2.\n // TODO(cais): Below
we split the input into individual 2D tensors,\n // perform QR decomposition on them and then stack the results
back\n // together. We should explore whether this can be parallelized.\n const outerDimsProd =
x.shape.slice(0, x.shape.length - 2)\n
.reduce((value, prev) => value * prev);\n const x2ds = unstack(\n reshape(\n x,\n
[\n outerDimsProd, x.shape[x.shape.length - 2],\n x.shape[x.shape.length - 1]\n]),\n 0);\n
const q2ds: Tensor2D[] = [];\n const r2ds: Tensor2D[] = [];\n x2ds.forEach(x2d => {\n const [q2d, r2d] =
qr2d(x2d as Tensor2D, fullMatrices);\n q2ds.push(q2d);\n r2ds.push(r2d);\n });\n const q =
reshape(stack(q2ds, 0), x.shape);\n const r = reshape(stack(r2ds, 0), x.shape);\n return [q, r];\n })\n}\n\nfunction
qr2d(x: Tensor2D, fullMatrices = false): [Tensor2D, Tensor2D] {\n return ENGINE.tidy(() => {\n assert(\n
x.shape.length === 2,\n () => `qr2d` requires a 2D Tensor, but got a ${\n x.shape.length}D
Tensor.`);\n const m = x.shape[0];\n const n = x.shape[1];\n let q = eye(m); // Orthogonal transform so
far.\n let r = clone(x); //
Transformed matrix so far.\n const one2D = tensor2d([[1], [1, 1]]);\n let w: Tensor2D = clone(one2D);\n\n
const iters = m >= n ? n : m;\n for (let j = 0; j < iters; ++j) {\n // This tidy within the for-loop ensures we clean
up temporary\n // tensors as soon as they are no longer needed.\n const rTemp = r;\n const wTemp = w;\n
const qTemp = q;\n [w, r, q] = ENGINE.tidy(): [Tensor2D, Tensor2D, Tensor2D] => {\n // Find H = I - tau
* w * w', to put zeros below R(j, j).\n const rjEnd1 = slice(r, [j, j], [m - j, 1]);\n const normX =
norm(rjEnd1);\n const rjj = slice(r, [j, j], [1, 1]);\n // The sign() function returns 0 on 0, which causes
division by zero.\n const s = where(greater(rjj, 0), tensor2d([-1]), tensor2d([1]));\n const u1 = sub(rjj,
mul(s, normX));\n const wPre = div(rjEnd1, u1);\n if (wPre.shape[0] === 1) {\n w = clone(one2D);\n
} else {\n
w = concat(\n [one2D,\n slice(wPre, [1, 0], [wPre.shape[0] - 1, wPre.shape[1]])] as\n
Tensor2D\n],\n 0);\n }\n const tau = neg(div(matMul(s, u1), normX)) as
Tensor2D;\n // -- R := HR, Q := QH.\n const rjEndAll = slice(r, [j, 0], [m - j, n]);\n const tauTimesW:
Tensor2D = mul(tau, w);\n const wT: Tensor2D = transpose(w);\n if (j === 0) {\n r = sub(rjEndAll,
matMul(tauTimesW, matMul(wT, rjEndAll))); \n } else {\n const rTimesTau: Tensor2D =\n
sub(rjEndAll, matMul(tauTimesW, matMul(wT, rjEndAll))); \n r = concat([slice(r, [0, 0], [j, n]), rTimesTau],
0);\n }\n const tauTimesWT: Tensor2D = transpose(tauTimesW);\n const qAllJEnd = slice(q, [0, j],
[m, q.shape[1] - j]);\n if (j === 0) {\n q = sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT));\n
} else {\n
const qTimesTau: Tensor2D =\n sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT));\n
q = concat([slice(q, [0, 0], [m, j]), qTimesTau], 1);\n }\n return [w, r, q];\n });\n }\n\n dispose([rTemp,
wTemp, qTemp]);\n }\n\n if (!fullMatrices && m > n) {\n q = slice(q, [0, 0], [m, n]);\n r = slice(r, [0, 0],
[n, n]);\n }\n\n return [q, r];\n }) as [Tensor2D, Tensor2D];\n }\n\n\nexport const qr = op({qr_});\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nexport enum Reduction {\n NONE,\n MEAN,\n SUM,\n SUM_BY_NONZERO_WEIGHTS\n }\n\n"/**\n *

```

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```
=====\n\n *^\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {cast} from './cast';\nimport {div} from './div';\nimport {Reduction} from './loss_ops_utils';\nimport {mean} from './mean';\nimport {mul} from './mul';\nimport {notEqual} from './not_equal';\nimport {ones} from './ones';\nimport {op} from './operation';\nimport {scalar} from './scalar';\nimport {sum} from './sum';\n\n/**\n * Computes the weighted loss between two tensors.\n *\n * @param losses Tensor of shape `[batch_size, d1, ... dN]`\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `losses`, and must be broadcastable to `losses` (i.e., all\n * dimensions must be either `1`, or the same as the corresponding\n * `losses` dimension).\n *\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n\nfunction computeWeightedLoss_<T extends Tensor, O extends Tensor>(\n losses: T|TensorLike, weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $losses = convertToTensor(losses, 'losses', 'computeWeightedLoss');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights, 'weights', 'computeWeightedLoss');\n }\n\n const weightedLoss = ($weights == null) ? $losses : mul($losses, $weights);\n\n if (reduction === Reduction.NONE) {\n return weightedLoss as O;\n }\n if (reduction === Reduction.SUM) {\n return sum(weightedLoss);\n }\n if (reduction === Reduction.MEAN) {\n if ($weights == null) {\n return mean(weightedLoss);\n } else {\n const broadcastFactor = $losses.size / $weights.size;\n const result = div(sum(weightedLoss), sum($weights));\n return broadcastFactor > 1 ? div(result, scalar(broadcastFactor)) :\n result as O;\n }\n }\n if (reduction === Reduction.SUM_BY_NONZERO_WEIGHTS) {\n if ($weights == null)\n {\n return div(sum(weightedLoss), scalar($losses.size));\n } else {\n const broadcastedWeights = mul($weights, ones($losses.shape));\n const numNonZeros =\n cast(sum(notEqual(broadcastedWeights, scalar(0))), 'float32');\n return div(sum(weightedLoss), numNonZeros);\n }\n }\n throw Error(`Unknown reduction: ${reduction}`);\n}\n\nexport const computeWeightedLoss = op({computeWeightedLoss_});\n\n**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
```

language governing permissions and\n \* limitations under the License.\n \*\n

```
=====\n\n *^\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {abs} from './abs';\nimport {Reduction} from './loss_ops_utils';\nimport {op} from './operation';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes the absolute difference loss between two tensors.\n *\n * @param labels The ground truth output tensor, same dimensions as\n * 'predictions'.
\n * @param predictions The predicted outputs.
\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n *\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n *\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n\nfunction absoluteDifference_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike, predictions: T|TensorLike,\n weights?: Tensor|TensorLike,\n
```



```

reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels',
'absoluteDifference');\n const $predictions =\n convertToTensor(predictions, 'predictions',
'absoluteDifference');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights =
convertToTensor(weights, 'weights', 'absoluteDifference');\n }\n assertShapesMatch(\n $labels.shape,
$predictions.shape, 'Error in absoluteDifference: ');
\n const losses = abs(sub($labels, $predictions));\n return
computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const absoluteDifference =
op({absoluteDifference_});\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from
'./loss_ops_utils';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {scalar}
from './scalar';\nimport {sub} from './sub';\nimport {sum} from './sum';\nimport {computeWeightedLoss} from
'./compute_weighted_loss';\n/**\n * Computes the cosine distance loss between two tensors.\n *\n * @param
labels The ground truth output tensor, same dimensions as\n * 'predictions'.\n * @param predictions The predicted
outputs.\n * @param axis The dimension along which the cosine distance is computed.\n * @param weights Tensor
whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n
* must be either `1`, or the same as the corresponding `losses`\n * dimension).\n * @param reduction Type of
reduction to apply to loss. Should be of type\n * `Reduction`\n *\n * @doc {heading: 'Training', subheading:
'Losses', namespace: 'losses'}\n *\nfunction cosineDistance_<T extends Tensor, O extends Tensor>(\n labels:
T|TensorLike, predictions: T|TensorLike, axis: number,\n weights?: Tensor|TensorLike,\n

```

```

reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels,
'labels', 'cosineDistance');\n const $predictions =\n convertToTensor(predictions, 'predictions',
'cosineDistance');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights,
'weights', 'cosineDistance');\n }\n assertShapesMatch(\n $labels.shape, $predictions.shape, 'Error in
cosineDistance: ');
\n const one = scalar(1);\n const losses = sub(one, sum(mul($labels, $predictions), axis,
true));\n return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const cosineDistance =
op({cosineDistance_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from
'./loss_ops_utils';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {relu} from
'./relu';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\nimport {computeWeightedLoss} from
'./compute_weighted_loss';\n/**\n * Computes the Hinge loss between two tensors.\n *\n * @param labels The
ground truth output tensor, same dimensions as\n * 'predictions'.\n *\n * @param predictions The predicted outputs.\n
* @param weights Tensor whose rank is either 0, or the same rank
as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as

```

```

the corresponding `losses` dimension).\n * @param reduction Type of reduction to apply to loss. Should be of
type\n * `Reduction`\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n */\nfunction
hingeLoss_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike, predictions: T|TensorLike,\n weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let $labels =
convertToTensor(labels, 'labels', 'hingeLoss');\n const $predictions = convertToTensor(predictions, 'predictions',
'hingeLoss');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights,
'weights', 'hingeLoss');\n }\n assertShapesMatch($labels.shape, $predictions.shape, 'Error
in hingeLoss: ');\n\n const one = scalar(1);\n // Convert binary labels to (-1, 1)\n $labels = sub(mul(scalar(2),
$labels), one);\n const losses = relu(sub(one, mul($labels, $predictions)));\n return computeWeightedLoss(losses,
$weights, reduction);\n}\n\nexport const hingeLoss = op({hingeLoss_});\n", "/*\n * @license\n * Copyright 2020
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {abs} from './abs';\nimport
{add} from './add';\nimport {Reduction} from './loss_ops_utils';\nimport {minimum} from './minimum';\nimport
{mul} from './mul';\nimport {op} from './operation';\nimport {scalar} from './scalar';\nimport {square} from
 './square';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from
'/compute_weighted_loss';\n\n/*\n * Computes the huber loss between two tensors.\n * @param labels The
ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n
 * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to
`labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses` dimension).\n
 * @param delta Point where huber loss changes from quadratic to linear.\n * @param reduction Type of reduction
to apply to loss. Should be of type\n * `Reduction`.\n * @doc {heading: 'Training', subheading: 'Losses',
namespace: 'losses'}\n */\nfunction huberLoss_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike,
predictions: T|TensorLike,\n weights?: Tensor|TensorLike, delta = 1.0,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels',
'huberLoss');\n const $predictions = convertToTensor(predictions, 'predictions', 'huberLoss');\n let $weights:
Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights, 'weights', 'huberLoss');\n }\n\n
assertShapesMatch($labels.shape, $predictions.shape, 'Error in huberLoss: ');\n\n const deltaScalar =
scalar(delta);\n const error = abs(sub($predictions, $labels));\n const quadratic = minimum(error, deltaScalar);\n\n
const linear = sub(error,
quadratic);\n\n const losses =\n add(mul(scalar(0.5), square(quadratic)), mul(deltaScalar, linear));\n return
computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const huberLoss = op({huberLoss_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor}
from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assertShapesMatch} from
 '../util';\nimport {add} from './add';\nimport {log} from './log';\nimport {Reduction} from

```



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```
=====
*
import {Tensor} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import {assertShapesMatch} from './util';
import {abs} from './abs';
import {add} from './add';
import {exp} from './exp';
import {log1p} from './log1p';
import {Reduction} from './loss_ops_utils';
import {mul} from './mul';
import {neg} from './neg';
import {op} from './operation';
import {relu} from './relu';
import {scalar} from './scalar';
import {sub} from './sub';
import {computeWeightedLoss} from './compute_weighted_loss';
function sigmoidCrossEntropyWithLogits<T extends Tensor, O extends Tensor>(
 labels: T|TensorLike, logits: T|TensorLike): O {
 const $labels = convertToTensor(labels, 'labels', 'sigmoidCrossEntropyWithLogits');
 const $logits = convertToTensor(logits, 'logits', 'sigmoidCrossEntropyWithLogits');
 assertShapesMatch($labels.shape, $logits.shape, 'Error in sigmoidCrossEntropyWithLogits: ');
 /**
 * Implementation Details:
 * For brevity, let `x = logits`, `z = labels`. The logistic loss is
 * $z * -\log(\text{sigmoid}(x)) + (1 - z) * -\log(1 - \text{sigmoid}(x))$
 * $= z * -\log(1 / (1 + \exp(-x))) + (1 - z) * -\log(\exp(-x) / (1 + \exp(-x)))$
 * $= z * \log(1 + \exp(-x)) + (1 - z) * (-\log(\exp(-x)) + \log(1 + \exp(-x)))$
 * $= z * \log(1 + \exp(-x)) + (1 - z) * (x + \log(1 + \exp(-x)))$
 * $= (1 - z) * x + \log(1 + \exp(-x))$
 * For $x < 0$, to avoid overflow in $\exp(-x)$, we reformulate the above
 * $x * z + \log(1 + \exp(-x)) = \log(\exp(x)) - x * z + \log(1 + \exp(-x))$
 * $= -x * z + \log(1 + \exp(x))$
 * Hence, to ensure stability and avoid overflow, the implementation uses
 * this equivalent formulation:
 * $\max(x, 0) - x * z + \log(1 + \exp(-\text{abs}(x)))$
 */
 const maxOutput = relu($logits);
 const outputXTarget = mul($logits, $labels);
 const sigmoidOutput = log1p(exp(neg(abs($logits))));
 return add(sub(maxOutput, outputXTarget), sigmoidOutput);
}
/**
 * Computes the sigmoid cross entropy loss between two tensors.
 * If labelSmoothing is nonzero, smooth the labels towards 1/2.
 * newMulticlassLabels = multiclassLabels * (1 - labelSmoothing) +
 * 0.5 * labelSmoothing
 * @param multiClassLabels The ground truth output tensor of shape [batch_size,
 * num_classes], same dimensions as 'predictions'.
 * @param logits The predicted outputs.
 * @param weights Tensor whose rank is either 0, or the same rank as `labels`, and must be broadcastable to `labels` (i.e., all dimensions
 * must be either `1`, or the same as the corresponding `losses` dimension).
 * @param labelSmoothing If greater than 0, then smooth the labels.
 * @param reduction Type of reduction to apply to loss. Should be of type
 * `Reduction`
 * @doc { heading: 'Training', subheading: 'Losses', namespace: 'losses' }
 */
function sigmoidCrossEntropy<T extends Tensor, O extends Tensor>(
 multiClassLabels: T|TensorLike, logits: T|TensorLike,
 weights?: Tensor|TensorLike, labelSmoothing = 0, reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
 let $multiClassLabels = convertToTensor(multiClassLabels, 'multiClassLabels', 'sigmoidCrossEntropy');
 const $logits = convertToTensor(logits, 'logits', 'sigmoidCrossEntropy');
 let $weights: Tensor = null;
 if (weights != null) {
 $weights = convertToTensor(weights, 'weights', 'sigmoidCrossEntropy');
 }
 assertShapesMatch($multiClassLabels.shape, $logits.shape, 'Error in sigmoidCrossEntropy: ');
 if (labelSmoothing > 0) {
 const labelSmoothingScalar = scalar(labelSmoothing);
 const one = scalar(1);
 const half = scalar(0.5);
 $multiClassLabels = add(mul($multiClassLabels, sub(one, labelSmoothingScalar)), mul(half, labelSmoothingScalar));
 }
 const losses = sigmoidCrossEntropyWithLogits($multiClassLabels, $logits);
 return computeWeightedLoss(losses, $weights, reduction);
}
export const sigmoidCrossEntropy = op({sigmoidCrossEntropy_});
/**
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```

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```
=====
\n
*\nimport {customGrad} from '../gradients';\nimport {Tensor} from '../tensor';\nimport {GradSaveFunc} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport {assertShapesMatch} from '../util';\nimport {add} from './add';\nimport
{expandShapeToKeepDim} from './axis_util';\nimport {cast} from './cast';\nimport {div} from './div';\nimport
{exp} from './exp';\nimport {logSumExp} from './log_sum_exp';\nimport {Reduction} from
'./loss_ops_utils';\nimport {mul} from './mul';\nimport {neg} from './neg';\nimport {op} from
'./operation';\nimport {reshape} from './reshape';\nimport {scalar} from './scalar';\nimport {sub} from
'./sub';\nimport {sum} from './sum';\nimport
{computeWeightedLoss} from './compute_weighted_loss';\n\n**\n * Computes softmax cross entropy between
logits and labels.\n * \n * Measures the probability error in discrete classification tasks in which\n * the
classes are mutually exclusive (each entry is in exactly one class).\n * For example, each CIFAR-10 image is
labeled with one and only one label: an\n * image can be a dog or a truck, but not both.\n * \n * `NOTE` :
While the classes are mutually exclusive, their probabilities need\n * not be. All that is required is that
each row of labels is a valid\n * probability distribution. If they are not, the computation of the gradient\n *
will be incorrect.\n * \n * `WARNING` : This op expects unscaled logits, since it performs a softmax on\n *
logits internally for efficiency. Do not call this op with the output of\n * softmax, as it will produce
incorrect results.\n * \n * logits and labels must have the same shape, e.g. [batch_size, num_classes]\n *
and the same dtype.\n * @param labels The labels array.\n * @param logits The logits array.\n * @param dim
The dimension softmax would be performed on. Defaults to -1\n * which indicates the last dimension.\n */\nfunction
softmaxCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(\n labels: T, logits: T, dim = -1): O {\n
if (dim === -1) {\n dim = logits.rank - 1;\n }\n if (dim !== logits.rank - 1) {\n throw Error(\n `Softmax
cross entropy along a non-last dimension is not yet\n `supported. Labels / logits was rank ${logits.rank}\n
` and dim was ${dim}`);\n }\n // Use a custom gradient for numerical stability.\n const customOp =\n customGrad((labels: Tensor, logits: Tensor, save: GradSaveFunc) => {\n // Reference:\n // 1.
http://cs231n.github.io/linear-classify/#softmax\n // 2. https://blog.feedly.com/tricks-of-the-trade-logsumexp/\n
const keepDims = true;\n const lse = logSumExp(logits, [dim], keepDims);\n const logResult =
sub(cast(logits, 'float32'), lse);\n save([labels, logResult]);\n const costVector =
neg(mul(logResult, labels));\n const value: O = sum(costVector, [dim]);\n const gradFunc = (dy: O,
saved: Tensor[]) => {\n const [labels, logResult] = saved;\n const dyShape =
expandShapeToKeepDim(dy.shape, [dim]);\n return [\n mul(reshape(dy, dyShape),\n
sub(cast(labels, 'float32'), exp(logResult))),\n mul(reshape(dy, dyShape),\n sub(exp(logResult),
cast(labels, 'float32'))),\n];\n }; return {value, gradFunc};\n });\n return customOp(labels,
logits);\n }\n\n**\n * Computes the softmax cross entropy loss between two tensors.\n * \n * If
labelSmoothing is nonzero, smooth the labels towards 1/2:\n * \n * newOnehotLabels = onehotLabels * (1 -
labelSmoothing)\n * + labelSmoothing / numClasses\n * \n * @param onehotLabels One
hot encoded labels\n * [batch_size, num_classes], same dimensions as 'predictions'.\n * @param logits The
predicted outputs.\n * @param weights Tensor whose rank is either 0, or 1, and must be\n * broadcastable to
`loss` of shape [batch_size]\n * @param labelSmoothing If greater than 0, then smooth the labels.\n * @param
reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * \n * @doc { heading:
'Training', subheading: 'Losses', namespace: 'losses' }\n */\nfunction softmaxCrossEntropy_<T extends Tensor, O
extends Tensor>(\n onehotLabels: T|TensorLike, logits: T|TensorLike,\n weights?: Tensor|TensorLike,
labelSmoothing = 0,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let $onehotLabels =\n convertToTensor(onehotLabels, 'onehotLabels', 'softmaxCrossEntropy');\n const $logits =
convertToTensor(logits,
```

```

'logits', 'softmaxCrossEntropy');\n let $weights: Tensor = null;\n\n if (weights != null) {\n $weights =
convertToTensor(weights,
'weights', 'softmaxCrossEntropy');\n }\n\n assertShapesMatch(\n $onehotLabels.shape, $logits.shape, 'Error in
softmaxCrossEntropy: ');
\n\n if (labelSmoothing > 0) {\n const labelSmoothingScalar = scalar(labelSmoothing);\n const one = scalar(1);\n const numClasses = scalar($onehotLabels.shape[1]);\n\n $onehotLabels =\nadd(mul($onehotLabels, sub(one, labelSmoothingScalar)),\n div(labelSmoothingScalar, numClasses));\n }\n\n const losses = softmaxCrossEntropyWithLogits_($onehotLabels, $logits);\n\n return
computeWeightedLoss(losses, $weights, reduction);\n}\n\n\nexport const softmaxCrossEntropy =
op({softmaxCrossEntropy_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n// Modularized ops.\nexport {abs} from './abs';\nexport {acos} from './acos';\nexport {acosh} from
 './acosh';\nexport {add} from './add';\nexport {addN} from './add_n';\nexport {all} from './all';\nexport {any} from
 './any';\nexport {argMax} from './arg_max';\nexport {argMin} from './arg_min';\nexport {asin} from './asin';\nexport
{asinh} from './asinh';\nexport {atan} from './atan';\nexport {atan2} from './atan2';\nexport {atanh} from
 './atanh';\nexport {avgPool} from './avg_pool';\nexport {avgPool3d} from './avg_pool_3d';\nexport
{basicLSTMCell} from './basic_lstm_cell';\nexport {batchToSpaceND}
from './batch_to_space_nd';\nexport {batchNorm} from './batchnorm';\nexport {batchNorm2d} from
 './batchnorm2d';\nexport {batchNorm3d} from './batchnorm3d';\nexport {batchNorm4d} from
 './batchnorm4d';\nexport {bincount} from './bincount';\nexport {broadcastTo} from './broadcast_to';\nexport {buffer}
from './buffer';\nexport {cast} from './cast';\nexport {ceil} from './ceil';\nexport {clipByValue} from
 './clip_by_value';\nexport {clone} from './clone';\nexport {complex} from './complex';\nexport {concat} from
 './concat';\nexport {concat1d} from './concat_1d';\nexport {concat2d} from './concat_2d';\nexport {concat3d} from
 './concat_3d';\nexport {concat4d} from './concat_4d';\nexport {conv1d} from './conv1d';\nexport {conv2d} from
 './conv2d';\nexport {conv2dTranspose} from './conv2d_transpose';\nexport {conv3d} from './conv3d';\nexport
{conv3dTranspose} from './conv3d_transpose';\nexport {cos} from './cos';\nexport {cosh} from './cosh';\nexport
{cumsum} from './cumsum';\nexport
{denseBincount} from './dense_bincount';\nexport {depthToSpace} from './depth_to_space';\nexport
{depthwiseConv2d} from './depthwise_conv2d';\nexport {diag} from './diag';\nexport {dilation2d} from
 './dilation2d';\nexport {div} from './div';\nexport {divNoNan} from './div_no_nan';\nexport {dot} from
 './dot';\nexport {elu} from './elu';\nexport {equal} from './equal';\nexport {erf} from './erf';\nexport {exp} from
 './exp';\nexport {expandDims} from './expand_dims';\nexport {expm1} from './expm1';\nexport {eye} from
 './eye';\nexport {fill} from './fill';\nexport {floor} from './floor';\nexport {floorDiv} from './floorDiv';\nexport
{gather} from './gather';\nexport {greater} from './greater';\nexport {greaterEqual} from './greater_equal';\nexport
{imag} from './imag';\nexport {isFinite} from './is_finite';\nexport {isInf} from './is_inf';\nexport {isNaN} from
 './is_nan';\nexport {leakyRelu} from './leaky_relu';\nexport {less} from './less';\nexport {lessEqual} from
 './less_equal';\nexport
{linspace} from './linspace';\nexport {localResponseNormalization} from './local_response_normalization';\nexport
{log} from './log';\nexport {log1p} from './log1p';\nexport {logSigmoid} from './log_sigmoid';\nexport
{logSoftmax} from './log_softmax';\nexport {logSumExp} from './log_sum_exp';\nexport {logicalAnd} from
 './logical_and';\nexport {logicalNot} from './logical_not';\nexport {logicalOr} from './logical_or';\nexport
{logicalXor} from './logical_xor';\nexport {matMul} from './mat_mul';\nexport {max} from './max';\nexport
{maxPool} from './max_pool';\nexport {maxPool3d} from './max_pool_3d';\nexport {maxPoolWithArgmax} from

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./max_pool_with_argmax';\nextport {maximum} from './maximum';\nextport {mean} from './mean';\nextport {min}
from './min';\nextport {minimum} from './minimum';\nextport {mirrorPad} from './mirror_pad';\nextport {mod} from
'/mod';\nextport {moments} from './moments';\nextport {mul} from './mul';\nextport {LSTMCellFunc,
multiRNNCell} from './multi_rnn_cell';\nextport
{multinomial} from './multinomial';\nextport {neg} from './neg';\nextport {notEqual} from './not_equal';\nextport
{oneHot} from './one_hot';\nextport {ones} from './ones';\nextport {onesLike} from './ones_like';\nextport
{outerProduct} from './outer_product';\nextport {pad} from './pad';\nextport {pad1d} from './pad1d';\nextport {pad2d}
from './pad2d';\nextport {pad3d} from './pad3d';\nextport {pad4d} from './pad4d';\nextport {pool} from
'/pool';\nextport {pow} from './pow';\nextport {prelu} from './prelu';\nextport {print} from './print';\nextport {prod}
from './prod';\nextport {rand} from './rand';\nextport {randomGamma} from './random_gamma';\nextport
{randomNormal} from './random_normal';\nextport {randomUniform} from './random_uniform';\nextport {range}
from './range';\nextport {real} from './real';\nextport {reciprocal} from './reciprocal';\nextport {relu} from
'/relu';\nextport {relu6} from './relu6';\nextport {reshape} from './reshape';\nextport {reverse} from './reverse';\nextport
{reverse1d} from './reverse_1d';\nextport
{reverse2d} from './reverse_2d';\nextport {reverse3d} from './reverse_3d';\nextport {reverse4d} from
'/reverse_4d';\nextport {round} from './round';\nextport {rsqrt} from './rsqrt';\nextport {scalar} from './scalar';\nextport
{selu} from './selu';\nextport {separableConv2d} from './separable_conv2d';\nextport {setdiff1dAsync} from
'/setdiff1d_async';\nextport {sigmoid} from './sigmoid';\nextport {sign} from './sign';\nextport {sin} from
'/sin';\nextport {sinh} from './sinh';\nextport {slice} from './slice';\nextport {slice1d} from './slice1d';\nextport
{slice2d} from './slice2d';\nextport {slice3d} from './slice3d';\nextport {slice4d} from './slice4d';\nextport {softmax}
from './softmax';\nextport {softplus} from './softplus';\nextport {spaceToBatchND} from
'/space_to_batch_nd';\nextport {fft} from './spectral/fft';\nextport {ifft} from './spectral/ifft';\nextport {irfft} from
'/spectral/irfft';\nextport {rfft} from './spectral/rfft';\nextport {split} from './split';\nextport {sqrt} from
'/sqrt';\nextport {square} from './square';\nextport {squaredDifference} from './squared_difference';\nextport
{squeeze} from './squeeze';\nextport {stack} from './stack';\nextport {step} from './step';\nextport {stridedSlice} from
'/strided_slice';\nextport {sub} from './sub';\nextport {sum} from './sum';\nextport {tan} from './tan';\nextport {tanh}
from './tanh';\nextport {tensor} from './tensor';\nextport {tensor1d} from './tensor1d';\nextport {tensor2d} from
'/tensor2d';\nextport {tensor3d} from './tensor3d';\nextport {tensor4d} from './tensor4d';\nextport {tensor5d} from
'/tensor5d';\nextport {tensor6d} from './tensor6d';\nextport {tile} from './tile';\nextport {topk} from './topk';\nextport
{truncatedNormal} from './truncated_normal';\nextport {unique} from './unique';\nextport {unsortedSegmentSum}
from './unsorted_segment_sum';\nextport {unstack} from './unstack';\nextport {variable} from './variable';\nextport
{where} from './where';\nextport {whereAsync} from './where_async';\nextport {zeros} from
'/zeros';\nextport {zerosLike} from './zeros_like';\n\nnextport * from './boolean_mask';\nextport * from
'/transpose';\nextport * from './norm';\nextport * from './moving_average';\nextport * from './scatter_nd';\nextport *
from './sparse_to_dense';\nextport * from './gather_nd';\nextport * from './dropout';\nextport * from
'/signal_ops_util';\nextport * from './in_top_k';\n\nnextport {op, OP_SCOPE_SUFFIX} from './operation';\n\nimport
{rfft} from './spectral/rfft';\nimport {fft} from './spectral/fft';\nimport {ifft} from './spectral/ifft';\nimport {irfft} from
'/spectral/irfft';\nconst spectral = {\n fft,\n ifft,\n rfft,\n irfft\n};\n\nimport * as fused from './fused_ops';\n\nimport
{hammingWindow} from './signal/hamming_window';\nimport {hannWindow} from
'/signal/hann_window';\nimport {frame} from './signal/frame';\nimport {stft} from './signal/stft';\nconst signal = {\n
hammingWindow,\n hannWindow,\n frame,\n stft,\n};\n\n// Image Ops namespace\nimport {cropAndResize}
from './image/crop_and_resize';\nimport
{flipLeftRight} from './image/flip_left_right';\nimport {rotateWithOffset} from
'/image/rotate_with_offset';\nimport {nonMaxSuppression} from './image/non_max_suppression';\nimport
{nonMaxSuppressionAsync} from './image/non_max_suppression_async';\nimport
{nonMaxSuppressionWithScore} from './image/non_max_suppression_with_score';\nimport
{nonMaxSuppressionWithScoreAsync} from './image/non_max_suppression_with_score_async';\nimport
{nonMaxSuppressionPadded} from './image/non_max_suppression_padded';\nimport

```

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{nonMaxSuppressionPaddedAsync} from './image/non_max_suppression_padded_async';\nimport {resizeBilinear}
from './image/resize_bilinear';\nimport {resizeNearestNeighbor} from './image/resize_nearest_neighbor';\nconst
image = {\n flipLeftRight,\n resizeNearestNeighbor,\n resizeBilinear,\n rotateWithOffset,\n cropAndResize,\n
nonMaxSuppression,\n nonMaxSuppressionAsync,\n nonMaxSuppressionWithScore,\n
nonMaxSuppressionWithScoreAsync,\n nonMaxSuppressionPadded,\n
nonMaxSuppressionPaddedAsync\n};\n\n// linalg namespace\nimport {bandPart} from
'/linalg/band_part';\nimport {gramSchmidt} from './linalg/gram_schmidt';\nimport {qr} from './linalg/qr';\nconst
linalg = {\n bandPart,\n gramSchmidt,\n qr\n};\n\n// losses namespace;\nimport {absoluteDifference} from
'/losses/absolute_difference';\nimport {computeWeightedLoss} from './losses/compute_weighted_loss';\nimport
{cosineDistance} from './losses/cosine_distance';\nimport {hingeLoss} from './losses/hinge_loss';\nimport
{huberLoss} from './losses/huber_loss';\nimport {logLoss} from './losses/log_loss';\nimport {meanSquaredError}
from './losses/mean_squared_error';\nimport {sigmoidCrossEntropy} from './losses/sigmoid_cross_entropy';\nimport
{softmaxCrossEntropy} from './losses/softmax_cross_entropy';\nconst losses = {\n absoluteDifference,\n
computeWeightedLoss,\n cosineDistance,\n hingeLoss,\n huberLoss,\n logLoss,\n meanSquaredError,\n
sigmoidCrossEntropy,\n softmaxCrossEntropy\n};\n\n//
Second level exports.\nexport {image, linalg, losses, spectral, fused, signal};\n", "/*\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {dispose} from './globals';\nimport {variableGrads} from './gradients';\nimport {scalar} from
'./ops/ops';\nimport {Serializable} from './serialization';\nimport
{Scalar, Variable} from './tensor';\nimport {NamedTensor, NamedTensorMap} from './tensor_types';\n\n/**\n * A
variable that belongs to an optimizer.\n *\n * The `originalName` field is required for keeping track of the
canonical\n * name of the variable, which is usually the name of the model weight that\n * the variable is related to
plus a suffix, e.g., 'dense1/kernel/momentum'.\n * The name of the `Variable` object itself cannot be used directly
due to\n * possible deduplication: Every `Variable` must have a unique name but more\n * than one optimizer
objects of the same type may be created for the same model\n * or the same `Variable`.\n */\n\nexport interface
OptimizerVariable {\n originalName: string;\n variable: Variable;\n}\n\n/** @doc {heading: 'Training',
subheading: 'Classes', namespace: 'train'} */\n\nexport abstract class Optimizer extends Serializable {\n protected
iterations_: number;\n\n /**\n * Executes `f()` and minimizes the scalar output of `f()` by computing\n
* gradients of y with respect to the list of trainable variables provided by\n * `varList`. If no list is provided, it
defaults to all trainable variables.\n *\n * @param f The function to execute and whose output to minimize.\n *
@param returnCost Whether to return the scalar cost value produced by\n * executing `f()`.\n * @param varList
An optional list of variables to update. If specified, only\n * the trainable variables in varList will be updated by
minimize. Defaults to\n * all trainable variables.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers'}\n
*\n\n minimize(f: () => Scalar, returnCost = false, varList?: Variable[]): Scalar\n | null {\n const {value, grads} =
this.computeGradients(f, varList);\n\n if (varList != null) {\n const gradArray: NamedTensor[] =\n
varList.map(v => ({name: v.name, tensor: grads[v.name]}));\n this.applyGradients(gradArray);\n } else {\n
this.applyGradients(grads);\n }\n\n
// Dispose gradients.\n dispose(grads);\n\n if (returnCost) {\n return value;\n } else {\n
value.dispose();\n return null;\n }\n }\n\n /**\n * The number of iterations that this optimizer instance has
been invoked for.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers'}\n *\n\n get iterations(): number {\n
if (this.iterations_ == null) {\n this.iterations_ = 0;\n }\n return this.iterations_;\n }\n\n protected incrementIterations() {\n
this.iterations_ = this.iterations_ + 1;\n }\n\n /**\n * Executes f() and computes the gradient of the scalar output of f() with\n
* respect to the list of

```



trainable variables provided by `varList`. If no `\* list` is provided, it defaults to all trainable variables.  
`@param f` The function to execute and whose output to use for computing gradients with respect to variables.  
`@param varList` An optional list of variables to compute gradients with respect to. If specified, only the trainable variables in `varList` will have

```
* gradients computed with respect to. Defaults to all trainable variables.
@doc {heading: 'Training',
subheading: 'Optimizers'}
computeGradients(f: () => Scalar, varList?: Variable[]):
 {value: Scalar,
 grads: NamedTensorMap} {
 return variableGrads(f, varList);
 }
/**
 * Updates variables by using the computed gradients.
 * @param variableGrads A mapping of variable name to its gradient value.
 * @doc {heading: 'Training', subheading: 'Optimizers'}
 * abstract applyGradients(variableGrads:
NamedTensorMap|
NamedTensor[]): void;
/**
 * Dispose the variables (if any) owned by this optimizer instance.
 * @param dispose(): void {
 if (this.iterations_ != null) {
 dispose(this.iterations_);
 }
}
async saveIterations(): Promise<NamedTensor> {
 if (this.iterations_ == null) {
 this.iterations_ = 0;
 }
 return {
 name: 'iter', // Named for
```

```
Python compatibility.
// TODO(cais): Use 'int64' type when available.
tensor: scalar(this.iterations_, 'int32')
};
} async getWeights(): Promise<NamedTensor[]> {
 throw new Error('getWeights() is not implemented for this optimizer yet.');} async setWeights(weightValues: NamedTensor[]): Promise<void> {
 throw new Error(`setWeights() is not implemented for this optimizer class ` +
`${this.getClassName()}`);
}
/**
 * Extract the first element of the weight values and set it as the iterations counter variable of this instance of optimizer.
 * @param weightValues
 * @returns Weight values with the first element consumed and excluded.
 * @protected
async extractIterations(weightValues: NamedTensor[]):
 Promise<NamedTensor[]> {
 this.iterations_ = (await weightValues[0].tensor.data())[0];
 return weightValues.slice(1);
 }
}
Object.defineProperty(Optimizer, Symbol.hasInstance, {
 value: (instance: Optimizer) => {
 return instance.minimize != null && instance.computeGradients != null &&
instance.applyGradients != null;
 }
});
"/**
 * @license
 * Copyright 2018 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License. */
```

```
=====
*
import {ENGINE} from '../engine';
import {dispose, tidy} from '../globals';
import {add} from '../ops/add';
import {div} from '../ops/div';
import {mul} from '../ops/mul';
import {sqrt} from '../ops/ops';
import {square} from '../ops/square';
import {zerosLike} from '../ops/zeros_like';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {NamedTensor, NamedVariableMap} from '../tensor_types';
import {Optimizer, OptimizerVariable} from './optimizer';
/** @doclink Optimizer */
@nextexport class AdadeltaOptimizer extends Optimizer {
 /** @nocollapse */
 static className = 'Adadelta';
 // Name matters for Python compatibility.
 private accumulatedGrads: OptimizerVariable[] = [];
 private accumulatedUpdates: OptimizerVariable[] = [];
 constructor(protected learningRate: number, protected rho: number,
 protected epsilon: number = null) {
 super();
 if (epsilon == null) {
 this.epsilon = ENGINE.backend.epsilon();
 }
 }
 applyGradients(variableGrads: NamedVariableMap|NamedTensor[]) {
 const variableNames = Array.isArray(variableGrads) ?
 variableGrads.map(item => item.name) :
 Object.keys(variableGrads);
 variableNames.forEach((name, i) => {
 const value = ENGINE.registeredVariables[name];
 const trainable = false;
 if (this.accumulatedGrads[i] == null) {
 this.accumulatedGrads[i] = {
 originalName: `${name}/accum_grad`,
 variable: tidy(() => zerosLike(value).variable(trainable))
 };
 }
 if (this.accumulatedUpdates[i] == null) {
 this.accumulatedUpdates[i] = {
 originalName: `${name}/accum_var`,
 variable: tidy(() =>
```

```

zerosLike(value).variable(trainable))\n });\n }\n const gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n return;\n }\n const accumulatedGrad = this.accumulatedGrads[i].variable;\n const accumulatedUpdate = this.accumulatedUpdates[i].variable;\n tidy() => {\n const\n newAccumulatedGrad =\n add(mul(accumulatedGrad, this.rho),\n mul(square(gradient), 1 -\n this.rho));\n const updates =\n mul(div(sqrt(add(accumulatedUpdate, this.epsilon)),\n sqrt(add(accumulatedGrad, this.epsilon))),\n gradient);\n const newAccumulatedUpdate =\n add(mul(accumulatedUpdate, this.rho),\n mul(square(updates), 1 - this.rho));\n accumulatedGrad.assign(newAccumulatedGrad);\n accumulatedUpdate.assign(newAccumulatedUpdate);\n const newValue = add(mul(updates, -this.learningRate), value);\n value.assign(newValue);\n });\n });\n this.incrementIterations();\n }\n dispose(): void {\n if (this.accumulatedUpdates != null) {\n dispose(this.accumulatedGrads.map(v => v.variable));\n dispose(this.accumulatedUpdates.map(v\n => v.variable));\n }\n }\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python\n compatibility.\n const variables: OptimizerVariable[] =\n [...this.accumulatedGrads,\n ...this.accumulatedUpdates];\n return [await this.saveIterations()].concat(\n variables.map(v => ({name:\n v.originalName, tensor: v.variable}));\n }\n }\n async setWeights(weightValues: NamedTensor[]): Promise<void>\n {\n weightValues = await this.extractIterations(weightValues);\n const variableCount = weightValues.length /\n 2;\n const trainable = false;\n this.accumulatedGrads =\n weightValues.slice(0, variableCount).map(v =>\n ({\n originalName: v.name,\n variable:\n v.tensor.variable(\n trainable)\n }));\n this.accumulatedUpdates =\n weightValues.slice(variableCount, variableCount * 2)\n .map(v => ({\n originalName:\n v.name,\n variable: v.tensor.variable(trainable)\n }));\n }\n }\n getConfig(): ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'rho': this.rho,\n 'epsilon': this.epsilon\n };}\n /**\n @nocollapse *\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config:\n ConfigDict): T {\n return new cls(config['learningRate'], config['rho'], config['epsilon']);\n }\n }\n registerClass(AdadeltaOptimizer);\n ", /**\n * @license\n * Copyright 2018 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *
\n http://www.apache.org/licenses/LICENSE-2.0\n *
\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n *\n *\n import {ENGINE} from './engine';\n import {dispose, tidy} from './globals';\n import {add} from\n './ops/add';\n import {div} from './ops/div';\n import {fill} from './ops/fill';\n import {mul} from './ops/mul';\n import\n {sqrt} from './ops/sqrt';\n import {square} from './ops/square';\n import {ConfigDict, registerClass, Serializable,\n SerializableConstructor} from './serialization';\n import {NamedTensor, NamedVariableMap} from\n './tensor_types';\n import {Optimizer, OptimizerVariable} from './optimizer';\n /** @doclink Optimizer\n *\n *\n export class AdagradOptimizer extends Optimizer {\n /** @nocollapse *\n static className = 'Adagrad';\n // Note: Name matters for Python compatibility.\n private accumulatedGrads: OptimizerVariable[] = [];\n constructor(\n protected learningRate: number, private initialAccumulatorValue = 0.1) {\n super();\n }\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const variableNames =\n Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) :\n Object.keys(variableGradients);\n variableNames.forEach((name, i) => {\n const value =\n ENGINE.registeredVariables[name];\n if (this.accumulatedGrads[i] == null) {\n const trainable = false;\n this.accumulatedGrads[i] = {\n originalName: `${name}/accumulator`,\n variable: tidy(\n () =>\n fill(value.shape, this.initialAccumulatorValue)\n .variable(trainable))\n };\n }\n const

```

```

gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\nvariableGradients[name];\n
 if (gradient == null) {\n return;\n }\n const accumulatedGrad =
this.accumulatedGrads[i].variable;\n\n tidy(() => {\n const newAccumulatedGrad = add(accumulatedGrad,
square(gradient));\n accumulatedGrad.assign(newAccumulatedGrad);\n\n const newValue = add(\n
mul(div(gradient,\n sqrt(add(newAccumulatedGrad, ENGINE.backend.epsilon()))),\n
this.learningRate),\n value);\n value.assign(newValue);\n });\n this.incrementIterations();\n
}\n\n dispose(): void {\n if (this.accumulatedGrads != null) {\n dispose(this.accumulatedGrads.map(v =>
v.variable));\n }\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python
compatibility.\n return [await this.saveIterations()].concat(this.accumulatedGrads.map(\n v => ({name:
v.originalName, tensor: v.variable}));\n }\n\n async setWeights(weightValues:
NamedTensor[]): Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n const
trainable = false;\n this.accumulatedGrads = weightValues.map(\n v => ({originalName: v.name, variable:
v.tensor.variable(trainable)}));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate':
this.learningRate,\n 'initialAccumulatorValue': this.initialAccumulatorValue,\n };\n }\n\n /** @nocollapse
*\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n
return new cls(config['learningRate'], config['initialAccumulatorValue']);\n
}\n\nregisterClass(AdagradOptimizer);\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from
../ops/add';\nimport {div} from '../ops/div';\nimport {mul} from '../ops/mul';\nimport {pow} from
../ops/pow';\nimport {scalar} from '../ops/scalar';\nimport {sqrt} from '../ops/sqrt';\nimport {square} from
../ops/square';\nimport {sub} from '../ops/sub';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict,
registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {Variable} from
../tensor';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\nimport
{Optimizer, OptimizerVariable} from '../optimizer';\n\nexport class AdamOptimizer extends Optimizer {\n /**
@nocollapse *\n static className = 'Adam'; // Note: Name matters for Python compatibility.\n private accBeta1:
Variable;\n private accBeta2: Variable;\n\n private accumulatedFirstMoment: OptimizerVariable[] = [];\n private
accumulatedSecondMoment: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number,\n
protected beta1: number,\n protected beta2: number, protected epsilon: number = null) {\n super();\n tidy(()
=> {\n // accB* will be updated by batch.\n this.accBeta1 = scalar(beta1).variable();\n this.accBeta2 =
scalar(beta2).variable();\n });\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n }\n
}\n\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const varNames =
Array.isArray(variableGradients) ?\n variableGradients.map(v => v.name)\n :\n Object.keys(variableGradients);\n tidy(() => {\n const oneMinusAccBeta1 = sub(1, this.accBeta1);\n
const oneMinusAccBeta2 = sub(1, this.accBeta2);\n\n varNames.forEach((name, i) => {\n const value =
ENGINE.registeredVariables[name];\n const trainable = false;\n if (this.accumulatedFirstMoment[i] ==
null) {\n this.accumulatedFirstMoment[i] = {\n originalName: `${name}/m`,\n variable: tidy(()
=> zerosLike(value).variable(trainable))\n };\n }\n if (this.accumulatedSecondMoment[i] ==
null) {\n this.accumulatedSecondMoment[i] = {\n originalName: `${name}/v`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n };\n }\n\n const gradient = Array.isArray(variableGradients)
?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n

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return;\n }\n\n const firstMoment = this.accumulatedFirstMoment[i].variable;\n const secondMoment = this.accumulatedSecondMoment[i].variable;\n\n const newFirstMoment =\n add(mul(firstMoment, this.beta1), mul(gradient, 1 - this.beta1));\n const newSecondMoment =\n add(mul(secondMoment, this.beta2),\n mul(square(gradient), 1 - this.beta2));\n const biasCorrectedFirstMoment =\n div(newFirstMoment, oneMinusAccBeta1);\n const biasCorrectedSecondMoment =\n div(newSecondMoment, oneMinusAccBeta2);\n firstMoment.assign(newFirstMoment);\n secondMoment.assign(newSecondMoment);\n\n const newValue =\n add(mul(div(biasCorrectedFirstMoment,\n -this.learningRate),\n add(sqrt(biasCorrectedSecondMoment), this.epsilon)),\n value);\n value.assign(newValue);\n });\n\n this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n\n this.accBeta2.assign(mul(this.accBeta2, this.beta2));\n });\n\n this.incrementIterations();\n }\n\n dispose(): void {\n this.accBeta1.dispose();\n this.accBeta2.dispose();\n\n if (this.accumulatedFirstMoment != null) {\n dispose(this.accumulatedFirstMoment.map(v => v.variable));\n }\n if (this.accumulatedSecondMoment != null) {\n dispose(this.accumulatedSecondMoment.map(v => v.variable));\n }\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python compatibility.\n const variables: OptimizerVariable[] =\n [...this.accumulatedFirstMoment, ...this.accumulatedSecondMoment];\n return [await this.saveIterations()].concat(\n variables.map(v => ({name: v.originalName, tensor: v.variable})));
 }\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n tidy(() => {\n this.accBeta1.assign(pow(this.beta1, this.iterations_ + 1));\n\n this.accBeta2.assign(pow(this.beta2, this.iterations_ + 1));\n });\n\n const variableCount = weightValues.length / 2;\n const trainable = false;\n this.accumulatedFirstMoment =\n weightValues.slice(0, variableCount).map(v => ({\n originalName: v.name,\n variable: v.tensor.variable(\n trainable)\n }));\n\n this.accumulatedSecondMoment =\n weightValues.slice(variableCount, variableCount * 2).\n .map(v => ({\n originalName: v.name,\n variable: v.tensor.variable(trainable)\n }));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'beta1': this.beta1,\n 'beta2': this.beta2,\n 'epsilon': this.epsilon,\n };
 }\n\n /** @nocollapse */\n\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(\n config['learningRate'], config['beta1'], config['beta2'],\n config['epsilon']);\n }\n\n }\n\n registerClass(AdamOptimizer);\n\n /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n =====\n\n *\n\n import\n\n {ENGINE} from '../engine';\n import {dispose, tidy} from '../globals';\n import {abs} from '../ops/abs';\n import {add} from '../ops/add';\n import {div} from '../ops/div';\n import {maximum} from '../ops/maximum';\n import {mul} from '../ops/mul';\n import {scalar} from '../ops/scalar';\n import {sub} from '../ops/sub';\n import {zerosLike} from '../ops/zeros_like';\n import {ConfigDict, registerClass, Serializable, SerializableConstructor} from\n './serialization';\n import {Variable} from './tensor';\n import {NamedTensor, NamedVariableMap} from\n './tensor_types';\n\n import {Optimizer, OptimizerVariable} from './optimizer';\n\n export class AdamaxOptimizer extends Optimizer {\n /** @nocollapse */\n static className = 'Adamax';\n // Note: Name matters for Python compatibility.\n private accBeta1: Variable;\n private iteration: Variable;\n\n private accumulatedFirstMoment:

```

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OptimizerVariable[] = [];\n private accumulatedWeightedInfNorm: OptimizerVariable[] = [];\n\n constructor(\n
protected
 learningRate: number, protected beta1: number,\n protected beta2: number, protected epsilon: number = null,\n
 protected decay = 0.0) {\n super();\n\n tidy(() => {\n this.iteration = scalar(0).variable();\n this.accBeta1 =
scalar(beta1).variable();\n });\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n }\n
}\n\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const variableNames =
Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) :\n
Object.keys(variableGradients);\n\n tidy(() => {\n const oneMinusAccBeta1 = sub(1, this.accBeta1);\n const
lr =\n div(-this.learningRate, add(mul(this.iteration, this.decay), 1));\n\n variableNames.forEach((name, i)
=> {\n const value = ENGINE.registeredVariables[name];\n const trainable = false;\n if
(this.accumulatedFirstMoment[i] == null) {\n this.accumulatedFirstMoment[i]
= {\n originalName: `${name}/m`,\n variable: zerosLike(value).variable(trainable)\n };\n
}\n if (this.accumulatedWeightedInfNorm[i] == null) {\n this.accumulatedWeightedInfNorm[i] = {\n
 originalName: `${name}/v`,\n variable: zerosLike(value).variable(trainable)\n };\n
}\n\n const
gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n
variableGradients[name];\n if (gradient == null) {\n return;\n }\n\n const firstMoment =
this.accumulatedFirstMoment[i].variable;\n const weightedInfNorm =
this.accumulatedWeightedInfNorm[i].variable;\n\n const newFirstMoment =\n add(mul(firstMoment,
this.beta1), mul(gradient, 1 - this.beta1));\n\n const ut0 = mul(weightedInfNorm, this.beta2);\n const ut1 =
abs(gradient);\n\n const newWeightedInfNorm = maximum(ut0, ut1);\n\n firstMoment.assign(newFirstMoment);\n
 weightedInfNorm.assign(newWeightedInfNorm);\n\n const
newValue =\n add(mul(div(lr, oneMinusAccBeta1),\n div(newFirstMoment,
add(newWeightedInfNorm, this.epsilon))),\n value);\n\n value.assign(newValue);\n });\n\n this.iteration.assign(add(this.iteration, 1));\n this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n });\n
this.incrementIterations();\n }\n\n dispose(): void {\n this.accBeta1.dispose();\n this.iteration.dispose();\n\n if (this.accumulatedFirstMoment != null) {\n dispose(this.accumulatedFirstMoment.map(v => v.variable));\n }\n
 if (this.accumulatedWeightedInfNorm != null) {\n dispose(this.accumulatedWeightedInfNorm.map(v =>
v.variable));\n }\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n throw new Error('getWeights() is
not implemented for Adamax yet.);\n }\n\n async setWeights(weightValues: NamedTensor[]):
Promise<void> {\n throw new Error('setWeights() is not implemented for Adamax yet.);\n }\n\n getConfig():
ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'beta1': this.beta1,\n 'beta2': this.beta2,\n
 'epsilon': this.epsilon,\n 'decay': this.decay\n };\n }\n\n /** @nocollapse */\n static fromConfig<T extends
Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(\n
config['learningRate'], config['beta1'], config['beta2'],\n config['epsilon'], config['decay']);\n }\n\n registerClass(AdamaxOptimizer);\n\n /**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n =====\n
*\n\n import {ENGINE} from './engine';\n import {keep, tidy} from './globals';\n import {add} from
'./ops/add';\n import {mul} from './ops/mul';\n import {scalar} from './ops/scalar';\n import {ConfigDict,
registerClass, Serializable, SerializableConstructor} from './serialization';\n import {Scalar} from './tensor';\n import
{NamedTensor, NamedTensorMap} from './tensor_types';\n\n import {Optimizer} from './optimizer';\n\n /**\n * @doclink Optimizer\n * @next export class SGDOptimizer extends Optimizer {\n * /** @nocollapse */\n * static className
= 'SGD';\n * // Note: Name matters for Python compatibility.\n * protected c: Scalar;\n * constructor(protected

```

```

learningRate: number) {\n super();\n this.setLearningRate(learningRate);\n }\n\napplyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {\n const varNames =
Array.isArray(variableGradients) ?\n variableGradients.map(v => v.name) :\n Object.keys(variableGradients);\n varNames.forEach((name, i) => {\n const gradient =
Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if
(gradient == null) {\n return;\n }\n const value = ENGINE.registeredVariables[name];\n tidy(() => {\n
 const newValue = add(mul(this.c, gradient), value);\n value.assign(newValue);\n });\n });\n this.incrementIterations();\n }\n\n /**\n * Sets the learning rate of the optimizer.\n */\n
setLearningRate(learningRate: number) {\n this.learningRate = learningRate;\n if (this.c != null) {\n
this.c.dispose();\n }\n this.c = keep(scalar(-learningRate));\n
}\n\n dispose() {\n this.c.dispose();\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n return [await
this.saveIterations()];\n }\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n
weightValues = await this.extractIterations(weightValues);\n if (weightValues.length !== 0) {\n throw new
Error('SGD optimizer does not have settable weights.);\n }\n }\n\n getConfig(): ConfigDict {\n return
{'learningRate': this.learningRate};\n }\n\n /** @nocollapse */\n static fromConfig<T extends Serializable>(cls:
SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(config['learningRate']);\n
}\n\nregisterClass(SGDOptimizer);\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */\n
=====
*\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from
 '../ops/add';\nimport {mul} from '../ops/mul';\nimport {scalar} from '../ops/scalar';\nimport {zerosLike} from
 '../ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from
 '../serialization';\nimport {Scalar, Tensor} from '../tensor';\nimport {NamedTensor, NamedVariableMap} from
 '../tensor_types';\nimport {OptimizerVariable} from '../optimizer';\nimport {SGDOptimizer} from
 '../sgd_optimizer';\n\n /** @doctest Optimizer */\nexport
class MomentumOptimizer extends SGDOptimizer {\n /** @nocollapse */\n static className = 'Momentum'; //
Name matters for Python compatibility.\n private m: Scalar;\n private accumulations: OptimizerVariable[] = [];\n\n
constructor(\n protected learningRate: number, private momentum: number,\n private useNesterov = false) {\n
 super(learningRate);\n this.m = scalar(this.momentum);\n }\n\n applyGradients(variableGradients:
NamedVariableMap|NamedTensor[]) {\n const variableNames = Array.isArray(variableGradients) ?\n
variableGradients.map(item => item.name) :\n Object.keys(variableGradients);\n variableNames.forEach((name, i) => {\n
 const value = ENGINE.registeredVariables[name];\n if
(this.accumulations[i] == null) {\n const trainable = false;\n this.accumulations[i] = {\n
 originalName: `${name}/momentum`,\n variable: tidy(() => zerosLike(value).variable(trainable))\n
 }; \n }\n const accumulation = this.accumulations[i].variable;\n const gradient = Array.isArray(variableGradients) ?\n
variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n return;\n
 }\n tidy(() => {\n let newValue: Tensor;\n const newAccumulation = add(mul(this.m, accumulation),
gradient);\n if (this.useNesterov) {\n newValue = add(\n mul(this.c, add(gradient,
mul(newAccumulation, this.m))), value);\n } else {\n newValue = add(mul(this.c, newAccumulation),
value);\n }\n accumulation.assign(newAccumulation);\n value.assign(newValue);\n });\n
 }\n\n this.incrementIterations();\n }\n\n dispose(): void {\n this.m.dispose();\n if (this.accumulations != null) {\n
dispose(this.accumulations.map(v => v.variable));\n }\n }\n\n /**\n * Sets the momentum of the optimizer.\n
*/\n

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*\n * @param momentum\n */\n setMomentum(momentum:
number) {\n this.momentum = momentum;\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order
matters for Python compatibility.\n return [await this.saveIterations()].concat(this.accumulations.map(\n v =>
({name: v.originalName, tensor: v.variable}));\n }\n\n async setWeights(weightValues: NamedTensor[]):
Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n const trainable = false;\n
this.accumulations = weightValues.map(\n v => ({originalName: v.name, variable:
v.tensor.variable(trainable)}));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate':
this.learningRate,\n 'momentum': this.momentum,\n 'useNesterov': this.useNesterov\n };}\n\n /**
@nocollapse */\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config:
ConfigDict): T {\n return new cls(\n config['learningRate'], config['momentum'], config['useNesterov']);\n
}\n\n registerClass(MomentumOptimizer);\n", "/**\n
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====*\n
*/\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from
 '../ops/add';\nimport {div} from '../ops/div';\nimport {mul} from '../ops/mul';\nimport {sqrt} from
 '../ops/sqrt';\nimport {square} from
 '../ops/square';\nimport {sub} from '../ops/sub';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict,
registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {NamedTensor,
NamedTensorMap} from '../tensor_types';\nimport {Optimizer, OptimizerVariable} from '../optimizer';\n\n/**
@doclink Optimizer */\n\nexport class RMSPropOptimizer extends Optimizer {\n /** @nocollapse */\n static
className = 'RMSProp'; // Note: Name matters for Python compatibility.\n private centered: boolean;\n\n private
accumulatedMeanSquares: OptimizerVariable[] = [];\n private accumulatedMoments: OptimizerVariable[] = [];\n
private accumulatedMeanGrads: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number,
protected decay = 0.9,\n protected momentum = 0.0, protected epsilon: number = null,\n centered = false) {\n
super();\n\n this.centered = centered;\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n
}\n\n if (learningRate == null) {\n throw new Error(`learningRate for RMSPropOptimizer must be
defined.`);\n }\n }\n\n applyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {\n const
variableNames = Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) :\n
Object.keys(variableGradients);\n\n variableNames.forEach((name, i) => {\n const value =
ENGINE.registeredVariables[name];\n const trainable = false;\n if (this.accumulatedMeanSquares[i] == null)
{\n this.accumulatedMeanSquares[i] = {\n originalName: `${name}/rms`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n };}\n\n if (this.accumulatedMoments[i] == null) {\n
this.accumulatedMoments[i] = {\n originalName: `${name}/momentum`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n };}\n\n if (this.accumulatedMeanGrads[i] == null &&
this.centered) {\n this.accumulatedMeanGrads[i] = {\n originalName: `${name}/mg`,\n variable:
tidy(() => zerosLike(value).variable(trainable))\n };}\n\n const gradient =
Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if
(gradient == null) {\n return;\n }\n\n const accumulatedMeanSquare =
this.accumulatedMeanSquares[i].variable;\n const accumulatedMoments =
this.accumulatedMoments[i].variable;\n tidy(() => {\n const newAccumulatedMeanSquare =\n
add(mul(accumulatedMeanSquare, this.decay),\n mul(square(gradient), 1 - this.decay));\n\n if
(this.centered) {\n const accumulatedMeanGrad = this.accumulatedMeanGrads[i].variable;\n // Centered
gradient\n const newAccumulatedMeanGrad =\n

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 mul(gradient, 1 - this.decay));\n\n
 const gradContribution =\n div(mul(gradient, this.learningRate),\n sqrt(\n
sub(newAccumulatedMeanSquare,\n add(square(newAccumulatedMeanGrad), this.epsilon)));\n
 const newAccumulatedMoments =\n add(mul(accumulatedMoments, this.momentum),\ngradContribution);\n accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n
accumulatedMeanGrad.assign(newAccumulatedMeanGrad);\n
accumulatedMoments.assign(newAccumulatedMoments);\n\n const newValue = sub(value,\nnewAccumulatedMoments);\n value.assign(newValue);\n } else {\n // Plain gradient\n const
newAccumulatedMeanSquare =\n add(mul(accumulatedMeanSquare, this.decay),\nmul(square(gradient), 1 - this.decay));\n\n const newAccumulatedMoments =\nadd(mul(accumulatedMoments, this.momentum),\n div(mul(gradient,\nthis.learningRate),\n sqrt(add(newAccumulatedMeanSquare, this.epsilon))));\n\n accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n
accumulatedMoments.assign(newAccumulatedMoments);\n\n const newValue = sub(value,\nnewAccumulatedMoments);\n value.assign(newValue);\n }\n });\n
this.incrementIterations();\n }\n\n dispose(): void {\n if (this.accumulatedMeanSquares != null) {\n
dispose(this.accumulatedMeanSquares.map(v => v.variable));\n }\n if (this.accumulatedMeanGrads != null &&\nthis.centered) {\n dispose(this.accumulatedMeanGrads.map(v => v.variable));\n }\n if
(this.accumulatedMoments != null) {\n dispose(this.accumulatedMoments.map(v => v.variable));\n }\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python compatibility.\n const variables:\nOptimizerVariable[] =\n [...this.accumulatedMeanSquares, ...this.accumulatedMoments];\n if (this.centered) {\n variables.push(...this.accumulatedMeanGrads);\n }\n return [await
this.saveIterations()].concat(\n variables.map(v => ({name: v.originalName, tensor: v.variable}));\n);\n }\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n weightValues = await
this.extractIterations(weightValues);\n const variableCount =\n this.centered ? weightValues.length / 3 :\nweightValues.length / 2;\n const trainable = false;\n this.accumulatedMeanSquares =\nweightValues.slice(0, variableCount).map(v => ({\n\n\n originalName: v.name,\n variable: v.tensor.variable(\n trainable)\n }));\n this.accumulatedMoments =\nweightValues.slice(variableCount, variableCount * 2)\n .map(v => ({\n\n\n originalName: v.name,\n variable: v.tensor.variable(trainable)\n }));\n if
(this.centered) {\n this.accumulatedMeanGrads =\nweightValues.slice(variableCount * 2, variableCount *\n3)\n .map(v => ({\n\n\n originalName: v.name,\n variable:\n v.tensor.variable(trainable)\n }));\n }\n }\n\n getConfig(): ConfigDict {\n return {\n
'learningRate': this.learningRate,\n 'decay': this.decay,\n 'momentum': this.momentum,\n 'epsilon':\nthis.epsilon,\n 'centered': this.centered\n };\n }\n\n /** @nocollapse */\n static fromConfig<T extends\nSerializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(\n
config['learningRate'], config['decay'], config['momentum'],\n config['epsilon'], config['centered']);\n }\n\n registerClass(RMSPropOptimizer);\n /**\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n *\n */\n =====\n\n *\nimport { AdadeltaOptimizer } from './adadelta_optimizer';\nimport { AdagradOptimizer } from
'./adagrad_optimizer';\nimport { AdamOptimizer } from './adam_optimizer';\nimport { AdamaxOptimizer } from

```



```

./adamax_optimizer';\nimport {MomentumOptimizer} from './momentum_optimizer';\nimport
{RMSPropOptimizer} from './rmsprop_optimizer';\nimport
{SGDOptimizer} from './sgd_optimizer';\n\nexport class OptimizerConstructors {\n /**\n * Constructs a
`tf.SGDOptimizer` that uses stochastic gradient descent.\n * \n * ```\n * // Fit a quadratic function by learning
the coefficients a, b, c.\n * const xs = tf.tensor1d([0, 1, 2, 3]);\n * const ys = tf.tensor1d([1.1, 5.9, 16.8, 33.9]);\n
*\n * const a = tf.scalar(Math.random()).variable();\n * const b = tf.scalar(Math.random()).variable();\n * const c
= tf.scalar(Math.random()).variable();\n * \n * // y = a * x^2 + b * x + c.\n * const f = x =>
a.mul(x.square()).add(b.mul(x)).add(c);\n * const loss = (pred, label) => pred.sub(label).square().mean();\n * \n
* const learningRate = 0.01;\n * const optimizer = tf.train.sgd(learningRate);\n * \n * // Train the model.\n * for
(let i = 0; i < 10; i++) {\n * optimizer.minimize(() => loss(f(xs), ys));\n * }\n * \n * // Make predictions.\n *
console.log(\n * `a: ${a.dataSync()},\n * b: ${b.dataSync()}, c: ${c.dataSync()}`);\n * const preds = f(xs).dataSync();\n *
preds.forEach((pred, i) => {\n * console.log(`x: ${i}, pred: ${pred}`);\n * });\n * ```\n * \n * @param learningRate The learning rate to use
for the SGD algorithm.\n * \n * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n * \n
* ^\n static sgd(learningRate: number): SGDOptimizer {\n return new SGDOptimizer(learningRate);\n }\n\n /**\n *
Constructs a `tf.MomentumOptimizer` that uses momentum gradient\n * descent.\n * \n * See\n *
[http://proceedings.mlr.press/v28/sutskever13.pdf](\n * http://proceedings.mlr.press/v28/sutskever13.pdf)\n * \n
* @param learningRate The learning rate to use for the Momentum gradient\n * descent algorithm.\n * @param
momentum The momentum to use for the momentum gradient descent\n * algorithm.\n * \n * @doc {heading:
'Training', subheading: 'Optimizers', namespace: 'train'}\n * \n
* ^\n static momentum(learningRate:
number, momentum: number, useNesterov = false):\n MomentumOptimizer {\n return new
MomentumOptimizer(learningRate, momentum, useNesterov);\n }\n\n /**\n * Constructs a
`tf.RMSPropOptimizer` that uses RMSProp gradient\n * descent. This implementation uses plain momentum and
is not centered\n * version of RMSProp.\n * \n * See\n *
[http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf](\n *
http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf)\n * \n * @param learningRate The
learning rate to use for the RMSProp gradient\n * descent algorithm.\n * @param decay The discounting factor
for the history/coming gradient.\n * @param momentum The momentum to use for the RMSProp gradient
descent\n * algorithm.\n * @param epsilon Small value to avoid zero denominator.\n * @param centered If true,
gradients are normalized by the estimated\n * variance of the gradient.\n * \n * @doc {heading: 'Training',
subheading:
'Optimizers', namespace: 'train'}\n * \n
* ^\n static rmsprop(\n learningRate: number, decay = .9, momentum = 0.0,
epsilon: number = null,\n centered = false): RMSPropOptimizer {\n return new RMSPropOptimizer(\n
learningRate, decay, momentum, epsilon, centered);\n }\n\n /**\n * Constructs a `tf.AdamOptimizer` that uses the
Adam algorithm.\n * See https://arxiv.org/abs/1412.6980\n * \n * @param
learningRate The learning rate to use for the Adam gradient\n * descent algorithm.\n * @param beta1 The
exponential decay rate for the 1st moment estimates.\n * @param beta2 The exponential decay rate for the 2nd
moment estimates.\n * @param epsilon A small constant for numerical stability.\n * \n * @doc {heading:
'Training', subheading: 'Optimizers', namespace: 'train'}\n * \n
* ^\n static adam(\n learningRate = 0.001, beta1 = 0.9,
beta2 = 0.999,\n epsilon: number = null): AdamOptimizer {\n return new AdamOptimizer(learningRate,
beta1, beta2, epsilon);\n }\n\n /**\n * Constructs a `tf.AdadeltaOptimizer` that uses the Adadelta algorithm.\n *
See https://arxiv.org/abs/1212.5701\n * \n * @param learningRate The learning
rate to use for the Adadelta gradient\n * descent algorithm.\n * @param rho The learning rate decay over each
update.\n * @param epsilon A constant epsilon used to better condition the grad\n * update.\n * \n * @doc
{heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n * \n
* ^\n static adadelta(learningRate = .001, rho =
.95, epsilon: number = null):\n AdadeltaOptimizer {\n return new AdadeltaOptimizer(learningRate, rho,
epsilon);\n }\n\n /**\n * Constructs a `tf.AdamaxOptimizer` that uses the Adamax algorithm.\n * See
https://arxiv.org/abs/1412.6980\n * \n * @param learningRate The learning rate

```

```

to use for the Adamax gradient descent algorithm.

@param beta1 The exponential decay rate for the 1st moment estimates.
@param beta2 The exponential decay rate for the 2nd moment estimates.
@param epsilon A small constant for numerical stability.
@param decay The learning rate decay over each update.
@doc {heading: 'Training', subheading: 'Optimizers',
namespace: 'train'}
static adamax(learningRate = 0.002, beta1 = 0.9, beta2 = 0.999, epsilon: number =
null, decay = 0.0): AdamaxOptimizer {
 return new AdamaxOptimizer(learningRate, beta1, beta2, epsilon,
 decay);
}

Constructs a `tf.AdagradOptimizer` that uses the Adagrad algorithm. See
[http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf](
http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf) or
[http://ruder.io/optimizing-gradient-descent/index.html#adagrad](
http://ruder.io/optimizing-gradient-descent/index.html#adagrad)

@param learningRate The learning
rate to use for the Adagrad gradient descent algorithm.
@param initialAccumulatorValue Starting value
for the accumulators, must be positive.

@doc {heading: 'Training', subheading: 'Optimizers',
namespace: 'train'}
static adagrad(learningRate: number, initialAccumulatorValue = 0.1):
AdagradOptimizer {
 return new AdagradOptimizer(learningRate, initialAccumulatorValue);
}

====
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copy of the License at http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable
law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for
the specific
language governing permissions and limitations under the License.

====
* So typings can propagate.
import {AdadeltaOptimizer} from './optimizers/adadelta_optimizer';
import {AdagradOptimizer} from './optimizers/adagrad_optimizer';
import {AdamOptimizer} from './optimizers/adam_optimizer';
import {AdamaxOptimizer} from './optimizers/adamax_optimizer';
import {MomentumOptimizer} from './optimizers/momentum_optimizer';
import {OptimizerConstructors} from './optimizers/optimizer_constructors';
import {RMSPropOptimizer} from './optimizers/rmsprop_optimizer';
import {SGDOptimizer} from './optimizers/sgd_optimizer';
// tslint:disable-next-line:no-unused-expression
[MomentumOptimizer, SGDOptimizer, AdadeltaOptimizer, AdagradOptimizer,
RMSPropOptimizer, AdamaxOptimizer, AdamOptimizer];
export const train = {
 sgd: OptimizerConstructors.sgd,
 momentum: OptimizerConstructors.momentum,
 adadelta: OptimizerConstructors.adadelta,
 adagrad: OptimizerConstructors.adagrad,
 rmsprop: OptimizerConstructors.rmsprop,
 adamax: OptimizerConstructors.adamax,
 adam: OptimizerConstructors.adam};

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http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or agreed to in writing,
software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language
governing permissions and limitations under the License.

====
* const delayCallback: Function = (() => {
 if (typeof requestAnimationFrame
 !== 'undefined') {
 return requestAnimationFrame;
 } else if (typeof setImmediate !== 'undefined') {
 return setImmediate;
 }
 return (f: Function) => f(); // no delays
})();

Returns a promise that resolve when
a requestAnimationFrame has completed. On Node.js this uses setImmediate instead of
requestAnimationFrame. This is simply a sugar method so that users can do the following:
`await tf.nextFrame();`

@doc {heading: 'Performance', subheading: 'Timing'}
function nextFrame():

```

```

Promise<void> {\n return new Promise<void>(resolve => delayCallback(() => resolve()));\n}\n\nexport
{nextFrame};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport * as util from './util';\n\nexport function assertParamsConsistent(shapes: number[][], axis: number) {\n
const rank = shapes[0].length;\n shapes.forEach((shape, i) => {\n util.assert(\n shape.length === rank,\n
() =>\n `Error in concat${rank}D: rank of tensors[${i}] must be the same ` +\n `as the rank of the rest
(${rank})`);\n });\n util.assert(\n axis >= 0 && axis < rank,\n () => `Error in concat${rank}D: axis must be
between 0 and ${rank - 1}`);\n const firstShape = shapes[0];\n shapes.forEach((shape, i) => {\n for
(let r = 0; r < rank; r++) {\n util.assert(\n (r === axis) || (shape[r] === firstShape[r]),\n () => `Error in
concat${rank}D: Shape of tensors[${i}] (${shape}) ` +\n `does not match the shape of the rest
(${firstShape}) ` +\n `along the non-concatenated axis ${i}`);\n }\n });\n}\n\nexport function
computeOutShape(shapes: number[][], axis: number): number[] {\n const outputShape = shapes[0].slice();\n for
(let i = 1; i < shapes.length; i++) {\n outputShape[axis] += shapes[i][axis];\n }\n return outputShape;\n}\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\n/**\n * Inputs of size above this threshold will be parallelized by calling multiple\n * shader programs.\n
*\nimport {nearestDivisor} from './util';\n\nexport const PARALLELIZE_THRESHOLD = 30;\n\nexport interface
ReduceInfo {\n windowSize: number;\n batchSize: number;\n inSize: number;\n outSize: number;\n}\n\nexport
function computeOptimalWindowSize(inSize: number): number {\n if (inSize <= PARALLELIZE_THRESHOLD)\n {\n return inSize;\n }\n return nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n}\n", "/*\n *
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\"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\n// Returns the image center in pixels.\n\nexport function getImageCenter(\n center: number|[number, number],
imageHeight: number,\n imageWidth: number): [number, number] {\n const centerX =\n imageWidth *
(typeof center === 'number' ? center : center[0]);\n const centerY =\n imageHeight * (typeof center ===
'number' ? center : center[1]);\n return [centerX, centerY];\n}\n", "/*\n * @license\n * Copyright 2018 Google
LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,

```

software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\n/**\n * Gets the new shape of the input Tensor after it's been reshaped\n * to:\n * [blockShape[0], ..., blockShape[M-1], batch / prod(blockShape),\n * inputShape[1], ..., inputShape[N-1]]\n *\n * See step 1: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n *\n * export function getReshaped(\n inputShape:\n number[], blockShape: number[], prod: number,\n batchToSpace = true): number[] {\n let reshaped: number[] = [];\n if (batchToSpace) {\n reshaped = reshaped.concat(blockShape.slice(0));\n reshaped.push(inputShape[0] / prod);\n reshaped = reshaped.concat(inputShape.slice(1));\n } else {\n reshaped = reshaped.concat(inputShape[0]);\n const spatialLength = blockShape.length;\n for (let i = 0; i < spatialLength; ++i) {\n reshaped =\n reshaped.concat([inputShape[i + 1] / blockShape[i], blockShape[i]]);\n }\n reshaped = reshaped.concat(inputShape.slice(spatialLength + 1));\n }\n return reshaped;\n }\n\n/**\n * Gets the permutation that will transpose the dimensions of the\n * reshaped tensor to shape:\n *\n * [batch / prod(block_shape),inputShape[1], blockShape[0], ..., \n * inputShape[M], blockShape[M-1],inputShape[M+1], ..., inputShape[N-1]]\n *\n * see step 2: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n *\n * export function getPermuted(\n reshapedRank: number, blockShapeRank: number,\n batchToSpace = true): number[] {\n const permuted = [];\n if (batchToSpace) {\n permuted.push(blockShapeRank);\n for (let i = blockShapeRank + 1; i < reshapedRank; ++i) {\n if (i <= 2 * blockShapeRank) {\n permuted.push(i);\n permuted.push(i - (blockShapeRank + 1));\n } else {\n permuted.push(i);\n }\n }\n } else {\n const permutedBeforeBatch = [];\n const permutedAfterBatch = [];\n for (let i = 1; i < reshapedRank; ++i) {\n if (i >= blockShapeRank * 2 + 1 || i % 2 === 1) {\n permutedAfterBatch.push(i);\n } else {\n permutedBeforeBatch.push(i);\n }\n }\n permuted.push(...permutedBeforeBatch);\n permuted.push(0);\n permuted.push(...permutedAfterBatch);\n }\n return permuted;\n }\n\n/**\n * Gets the shape of the reshaped and permuted input Tensor before any cropping\n * is applied. The new shape will be:\n *\n * [batch / prod(blockShape),inputShape[1]\n * blockShape[0], ..., \n * inputShape[M] * blockShape[M-1],inputShape[M+1], ..., inputShape[N-1]]\n *\n * See step 3: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n *\n * export function getReshapedPermuted(\n inputShape: number[], blockShape: number[], prod: number,\n batchToSpace = true): number[] {\n const reshapedPermuted = [];\n if (batchToSpace) {\n reshapedPermuted.push(inputShape[0] / prod);\n } else {\n reshapedPermuted.push(inputShape[0] * prod);\n }\n for (let i = 1; i < inputShape.length; ++i) {\n if (i <= blockShape.length) {\n if (batchToSpace) {\n reshapedPermuted.push(blockShape[i - 1] * inputShape[i]);\n } else {\n reshapedPermuted.push(inputShape[i] / blockShape[i - 1]);\n }\n } else {\n reshapedPermuted.push(inputShape[i]);\n }\n }\n return reshapedPermuted;\n }\n\n/**\n * Converts the crops argument into the beginning coordinates of a slice\n * operation.\n *\n * export function getSliceBeginCoords(\n crops: number[][], blockShape: number): number[] {\n const sliceBeginCoords = [0];\n for (let i = 0; i < blockShape; ++i) {\n sliceBeginCoords.push(crops[i][0]);\n }\n return sliceBeginCoords;\n }\n\n/**\n * Converts the crops argument into the size of a slice operation. When\n * combined with getSliceBeginCoords this function allows the reshaped and\n * permuted Tensor to be cropped to its final output shape of:\n *\n * inputShape[1] * blockShape[0] - crops[0,0] - crops[0,1], ..., \n * inputShape[M] * blockShape[M-1] -crops[M-1,0] -\n * crops[M-1,1],inputShape[M+1], ..., inputShape[N-1]]\n *\n * See step 4: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n *\n * export function getSliceSize(\n uncroppedShape: number[], crops: number[][], blockShape: number): number[] {\n const sliceSize = uncroppedShape.slice(0, 1);\n for (let i = 0; i < blockShape; ++i) {\n sliceSize.push(uncroppedShape[i + 1] - crops[i][0])
```

- crops[i][1]);\n }\n\n return sliceSize;\n}\n\n"/\*\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nexport const SELU_SCALEALPHA = 1.7580993408473768599402175208123;\nexport const SELU_SCALE = 1.0507009873554804934193349852946;\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nexport const ERF_P = 0.3275911;\nexport const ERF_A1 = 0.254829592;\nexport const ERF_A2 = -0.284496736;\nexport const ERF_A3 = 1.421413741;\nexport const ERF_A4 = -1.453152027;\nexport const ERF_A5 = 1.061405429;\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {env} from './environment';\nexport function warn(...msg: Array<{}>): void {\n if (!env().getBool('IS_TEST')) {\n console.warn(...msg);\n }\n}\n\nexport function log(...msg: Array<{}>): void {\n if (!env().getBool('IS_TEST')) {\n console.log(...msg);\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {TypedArray} from './types';\n/**\n * Merges real and imaginary Float32Arrays into a single complex Float32Array.\n * The memory layout is interleaved as follows:\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n * complex: [r0, i0, r1, i1, r2, i2]\n * This is the inverse of splitRealAndImagArrays.\n * @param real The real values of the complex tensor values.\n * @param imag The imag values of the complex tensor values.\n * @returns A complex tensor as a Float32Array with merged values.\n */\nexport function mergeRealAndImagArrays(\n real: Float32Array, imag: Float32Array): Float32Array {\n if (real.length !== imag.length) {\n throw new Error(\n `Cannot merge real and imag arrays of different lengths. real: ` +\n `${real.length}, imag: ${imag.length}.`);\n }\n const result = new Float32Array(real.length * 2);\n for (let i = 0; i < result.length; i += 2) {\n result[i] = real[i / 2];\n result[i + 1] = imag[i / 2];\n }\n return result;\n}\n\n/**\n * Splits a complex Float32Array into real and imag parts.\n * The memory layout is interleaved as follows:\n *
```

```

complex: [r0, i0, r1, i1, r2, i2]\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n *\n * This is the inverse of
mergeRealAndImagArrays.\n *\n * @param complex The complex tensor values.\n *\n * @returns An object with real
and imag Float32Array components of the complex\n * tensor.\n */\nexport
function splitRealAndImagArrays(complex: Float32Array):\n {real: Float32Array, imag: Float32Array} {\n
const real = new Float32Array(complex.length / 2);\n const imag = new Float32Array(complex.length / 2);\n for
(let i = 0; i < complex.length; i += 2) {\n real[i / 2] = complex[i];\n imag[i / 2] = complex[i + 1];\n }\n return
{real, imag};\n}\n\n/**\n * Extracts even indexed complex values in the given array.\n *\n * @param complex The
complex tensor values\n */\nexport function complexWithEvenIndex(complex: Float32Array):\n {real:
Float32Array, imag: Float32Array} {\n const len = Math.ceil(complex.length / 4);\n const real = new
Float32Array(len);\n const imag = new Float32Array(len);\n for (let i = 0; i < complex.length; i += 4) {\n
real[Math.floor(i / 4)] = complex[i];\n imag[Math.floor(i / 4)] = complex[i + 1];\n }\n return {real,
imag};\n}\n\n/**\n * Extracts odd indexed comple values in the given array.\n *\n * @param complex The complex
tensor values\n */\nexport
function complexWithOddIndex(complex: Float32Array):\n {real: Float32Array, imag: Float32Array} {\n const
len = Math.floor(complex.length / 4);\n const real = new Float32Array(len);\n const imag = new
Float32Array(len);\n for (let i = 2; i < complex.length; i += 4) {\n real[Math.floor(i / 4)] = complex[i];\n
imag[Math.floor(i / 4)] = complex[i + 1];\n }\n return {real, imag};\n}\n\n/**\n * Get the map representing a
complex value in the given array.\n *\n * @param complex The complex tensor values.\n *\n * @param index An index of
the target complex value.\n */\nexport function getComplexWithIndex(\n complex: Float32Array, index: number):\n
{real: number, imag: number} {\n const real = complex[index * 2];\n const imag = complex[index * 2 + 1];\n
return {real, imag};\n}\n\n/**\n * Insert a given complex value into the TypedArray.\n *\n * @param data The array in
which the complex value is inserted.\n *\n * @param c The complex value to be inserted.\n *\n * @param index An index
of
the target complex value.\n */\nexport function assignToTypedArray(\n data: TypedArray, real: number, imag:
number, index: number) {\n data[index * 2] = real;\n data[index * 2 + 1] = imag;\n}\n\n/**\n * Make the list of
exponent terms used by FFT.\n */\nexport function exponents(\n n: number, inverse: boolean): {real:
Float32Array, imag: Float32Array} {\n const real = new Float32Array(n / 2);\n const imag = new Float32Array(n /
2);\n for (let i = 0; i < Math.ceil(n / 2); i++) {\n const x = (inverse ? 2 : -2) * Math.PI * (i / n);\n real[i] =
Math.cos(x);\n imag[i] = Math.sin(x);\n }\n return {real, imag};\n}\n\n/**\n * Make the exponent term used by
FFT.\n */\nexport function exponent(\n k: number, n: number, inverse: boolean): {real: number, imag: number}
{\n const x = (inverse ? 2 : -2) * Math.PI * (k / n);\n const real = Math.cos(x);\n const imag = Math.sin(x);\n
return {real, imag};\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\nimport {TensorInfo} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {assert} from
'./util';\n\n/**\n * Prepare the split size array. When the input is a number, the axis is evenly\n * divided among the
split size. When the input contains the negative value, the\n * rest of the axis is allocated toward that.\n */\nexport
function prepareSplitSize(\n x: Tensor|TensorInfo, numOrSizeSplits: number[]|number,\n axis = 0): number[]\n {\n let
splitSizes = [];\n if (typeof (numOrSizeSplits) === 'number') {\n assert(\n x.shape[axis] %
numOrSizeSplits === 0,\n () => 'Number of splits must evenly divide the axis.);\n splitSizes =\n new
Array(numOrSizeSplits).fill(x.shape[axis] / numOrSizeSplits);\n } else {\n const numOfNegs =
numOrSizeSplits.reduce((count, value) => {\n if (value === -1) {\n count += 1;\n }\n return count;\n
}, 0);\n assert(\n numOfNegs <= 1,\n () => 'There should be only one negative value in split array.);\n
}

```

```

const negIndex = numOrSizeSplits.indexOf(-1);\n // Allow the number of split array to be -1, which indicates the
rest\n // of dimension is allocated to that split.\n if (negIndex !== -1) {\n const total =
numOrSizeSplits.reduce((a, b) => b > 0 ? a + b : a);\n numOrSizeSplits[negIndex]
= x.shape[axis] - total;\n } \n assert(\n x.shape[axis] === numOrSizeSplits.reduce((a, b) => a + b),\n ()
=> "The sum of sizes must match the size of the axis dimension.");\n splitSizes = numOrSizeSplits;\n } \n\n return
splitSizes;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport {TensorInfo}
from './kernel_registry';\nimport {nearestDivisor} from './util';\n\nimport {PARALLELIZE_THRESHOLD} from
'./reduce_util';\n\nexport interface SegOpInfo {\n windowSize: number;\n batchSize: number;\n inSize: number;\n
numSegments: number;\n}\n\nexport function segOpComputeOptimalWindowSize(\n inSize: number,
numSegments: number): number {\n let done = false;\n let res;\n\n if (inSize <= PARALLELIZE_THRESHOLD)
{\n res = inSize;\n done = true;\n } else {\n res = nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n
}\n\n while (!done) {\n if (res > numSegments || res === inSize) {\n done = true;\n } else {\n res =
nearestDivisor(inSize, res + 1);\n }\n }\n return res;\n}\n\nexport function computeOutShape(\n aShape:
number[], axis: number, numSegments: number): number[] {\n const outShape = [];\n const rank =
aShape.length;\n for (let dim = 0; dim < rank; dim++) {\n if (dim !== axis) {\n outShape.push(aShape[dim]);\n

```

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} else {\n outShape.push(numSegments);\n }\n }\n return outShape;\n}\n\nexport interface
GatherOpShapeInfo {\n batchSize: number;\n sliceSize: number;\n outerSize: number;\n dimSize: number;\n
outputShape: number[];\n}\n\nexport function collectGatherOpShapeInfo(\n x: TensorInfo, indices: TensorInfo,
axis: number, \n batchDims: number): GatherOpShapeInfo {\n const indicesRank = indices.shape.length;\n const
xRank = x.shape.length;\n if (batchDims !== 0) {\n if (batchDims < -indicesRank || batchDims > indicesRank)
{\n throw new Error(`Expect batchDims in the range of [-${indicesRank}, ${indicesRank}], but got
${batchDims}`);\n }\n if (batchDims < 0) {\n batchDims += indicesRank;\n }\n if (batchDims >
xRank) {\n throw new Error(`batchDims (${batchDims}) must be less than rank(x) (\n ${xRank}).`);\n }\n if
(axis < batchDims) {\n throw new Error(`batchDims (${batchDims}) must be less than or equal to axis
(${axis}).`);\n }\n for (let i = 0; i < batchDims; ++i) {\n if (x.shape[i] !== indices.shape[i]) {\n throw new
Error(\n `x.shape[${i}]: ${x.shape[i]} should be equal to indices.shape[${i}]:
${indices.shape[i]}`);\n }\n }\n const dimSize = x.shape[axis];\n const outputShape: number[] = [];\n let
batchSize = 1;\n let outerSize = 1;\n let sliceSize = 1;\n\n for (let i = 0; i < batchDims; ++i) {\n
outputShape.push(x.shape[i]);\n batchSize *= x.shape[i];\n }\n\n for (let i = batchDims; i < axis; i++) {\n
outputShape.push(x.shape[i]);\n outerSize *= x.shape[i];\n }\n\n for (let i = batchDims; i < indicesRank; i++) {\n
outputShape.push(indices.shape[i]);\n }\n\n for (let i = axis + 1; i < xRank; i++) {\n
outputShape.push(x.shape[i]);\n sliceSize *= x.shape[i];\n }\n\n return {batchSize, sliceSize, outerSize, dimSize,
outputShape};\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====
*\n\nimport {decodeString, encodeString} from './util';\n\n// Utilities needed by backend consumers of tf-
core.\nexport * from './ops/axis_util';\nexport * from './ops/broadcast_util';\nexport * from
 './ops/concat_util';\nexport * from './ops/conv_util';\nexport * from './ops/fused_util';\nexport * from
 './ops/fused_types';\nexport * from './ops/reduce_util';\n\nimport
 * as slice_util from './ops/slice_util';\nexport {slice_util};\n\nexport {BackendValues, TypedArray, upcastType,
 PixelData} from './types';\nexport {MemoryInfo, TimingInfo} from './engine';\nexport * from
 './ops/rotate_util';\nexport * from './ops/array_ops_util';\nexport * from './ops/gather_nd_util';\nexport * from
 './ops/scatter_nd_util';\nexport * from './ops/selu_util';\nexport * from './ops/fused_util';\nexport * from
 './ops/erf_util';\nexport * from './log';\nexport * from './backends/complex_util';\nexport * from
 './ops/split_util';\n\nimport * as segment_util from './ops/segment_util';\nexport {segment_util};\n\nexport function
 fromUint8ToStringArray(vals: Uint8Array[]) {\n try {\n // Decode the bytes into string.\n return vals.map(val
 => decodeString(val));\n } catch (err) {\n throw new Error(\n `Failed to decode encoded string bytes into utf-
8, error: ${err}`);\n }\n}\n\nexport function fromStringArrayToUint8(strings:
 string[]) {\n return strings.map(s => encodeString(s));\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC.
 All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
 file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
=====
*\n\nexport {nonMaxSuppressionV3Impl, nonMaxSuppressionV4Impl, nonMaxSuppressionV5Impl} from
 './non_max_suppression_impl';\nexport {whereImpl} from './where_impl';\n\n",/**\n * @license\n * Copyright 2020
 Google Inc.
 All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
 this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
=====
*\n\n// base.ts is tfjs-core without auto registration of things like flags,\n// gradients, chained ops or the opHandler.
 See base_side_effects.ts for parts\n// tfjs core that are required side effects.\n\n/**\n * @fileoverview\n * @suppress
 {partialAlias} Optimization disabled due to passing the module\n * object into a function
 below:\n * \n * import * as ops from './ops/ops';\n * setOpHandler(ops);\n * \n * \n * \n // Serialization.\n\nimport * as io
 from './io/io';\n\nimport * as math from './math';\n\nimport * as browser from './ops/browser';\n\nimport * as gather_util
 from './ops/gather_nd_util';\n\nimport * as scatter_util from './ops/scatter_nd_util';\n\nimport * as slice_util from
 './ops/slice_util';\n\nimport * as serialization from './serialization';\n\nimport * as tensor_util from './tensor_util';\n\nimport
 * as test_util from './test_util';\n\nimport * as util from './util';\n\nimport {version} from './version';\n\nexport
 {InferenceModel, MetaGraph, MetaGraphInfo, ModelPredictConfig, ModelTensorInfo, SavedModelTensorInfo,
 SignatureDef, SignatureDefEntry, SignatureDefInfo} from './model_types';\n\n// Optimizers.\n\nexport
 {AdadeltaOptimizer} from './optimizers/adadelta_optimizer';\n\nexport {AdagradOptimizer} from
 './optimizers/adagrad_optimizer';\n\nexport {AdamOptimizer} from './optimizers/adam_optimizer';\n\nexport
 {AdamaxOptimizer}
 from './optimizers/adamax_optimizer';\n\nexport {MomentumOptimizer} from
 './optimizers/momentum_optimizer';\n\nexport {Optimizer} from './optimizers/optimizer';\n\nexport
 {RMSPropOptimizer} from './optimizers/rmsprop_optimizer';\n\nexport {SGDOptimizer} from

```



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./optimizers/sgd_optimizer';\nexport {Scalar, Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D, Tensor5D,
TensorBuffer, Variable} from './tensor';\nexport {GradSaveFunc, NamedTensorMap, TensorContainer,
TensorContainerArray, TensorContainerObject} from './tensor_types';\nexport {BackendValues, DataType,
DataTypeMap, DataValues, NumericDataType, PixelData, Rank, RecursiveArray, ScalarLike, ShapeMap,
sumOutType, TensorLike, TypedArray, upcastType} from './types';\n\nexport * from './ops/ops';\nexport
{Reduction} from './ops/loss_ops_utils';\n\nexport * from './train';\nexport * from './globals';\nexport * from
'/kernel_registry';\nexport {customGrad, grad, grads, valueAndGrad, valueAndGrads, variableGrads} from
'/gradients';\n\nexport {TimingInfo,
MemoryInfo, ForwardFunc} from './engine';\nexport {Environment, env, ENV} from './environment';\nexport
{Platform} from './platforms/platform';\n\nexport {version as version_core};\n\n// Top-level method
exports.\nexport {nextFrame} from './browser_util';\n\n// Second level exports.\nimport * as backend_util from
'/backends/backend_util';\nimport * as device_util from './device_util';\nexport {\n browser,\n io,\n math,\n
serialization,\n test_util,\n util,\n backend_util,\n tensor_util,\n slice_util,\n gather_util,\n scatter_util,\n
device_util\n};\n\nimport * as kernel_impls from './backends/kernel_impls';\nexport {kernel_impls};\n\n// Backend
specific.\nexport {KernelBackend, BackendTimingInfo, DataMover, DataStorage} from './backends/backend';\n\n//
Export all kernel names / info.\nexport * from './kernel_names';\n\n"/**\n * @license\n * Copyright 2017 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\n// Required side effectful code.\nimport './base_side_effects';\n\n// All exports from this package should be in
base.\nexport * from './base';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nconst contexts: {[key: string]: WebGLRenderingContext} = {};\n\nconst WEBGL_ATTRIBUTES:
WebGLContextAttributes = {\n alpha: false,\n antialias: false,\n premultipliedAlpha: false,\n
preserveDrawingBuffer: false,\n depth: false,\n stencil: false,\n failIfMajorPerformanceCaveat: true\n};\n\nexport
function clearWebGLContext(webGLVersion: number) {\n delete contexts[webGLVersion];\n}\n\nexport function
setWebGLContext(\n webGLVersion: number, gl: WebGLRenderingContext) {\n contexts[webGLVersion] =
gl;\n}\n\nexport function getWebGLContext(webGLVersion:
number): WebGLRenderingContext {\n if (!(webGLVersion in contexts)) {\n const newCtx =
getWebGLRenderingContext(webGLVersion);\n if (newCtx !== null) {\n contexts[webGLVersion] =
newCtx;\n } else {\n console.log('Could not get context for WebGL version', webGLVersion);\n return
null;\n }\n }\n const gl = contexts[webGLVersion];\n if (gl.isContextLost()) {\n delete
contexts[webGLVersion];\n return getWebGLContext(webGLVersion);\n }\n\n gl.disable(gl.DEPTH_TEST);\n
gl.disable(gl.STENCIL_TEST);\n gl.disable(gl.BLEND);\n gl.disable(gl.DITHER);\n
gl.disable(gl.POLYGON_OFFSET_FILL);\n gl.disable(gl.SAMPLE_COVERAGE);\n
gl.enable(gl.SCISSOR_TEST);\n gl.enable(gl.CULL_FACE);\n gl.cullFace(gl.BACK);\n\n return
contexts[webGLVersion];\n}\n\nfunction createCanvas(webGLVersion: number) {\n if (typeof OffscreenCanvas

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!== 'undefined' && WebGLVersion === 2) {\n return new OffscreenCanvas(300, 150);\n } else if (typeof
document !==
'undefined') {\n return document.createElement('canvas');\n } else {\n throw new Error('Cannot create a canvas
in this context');\n }\n}\n\nfunction getWebGLRenderingContext(webGLVersion: number):
WebGLRenderingContext {\n if (webGLVersion !== 1 && WebGLVersion !== 2) {\n throw new Error('Cannot
get WebGL rendering context, WebGL is disabled.);\n }\n const canvas = createCanvas(webGLVersion);\n\n canvas.addEventListener('webglcontextlost', (ev: Event) => {\n ev.preventDefault();\n delete
contexts[webGLVersion];\n }, false);\n if (webGLVersion === 1) {\n return (canvas.getContext('webgl',
WEBGL_ATTRIBUTES) ||\n canvas.getContext('experimental-webgl', WEBGL_ATTRIBUTES)) as\n WebGLRenderingContext;\n }\n return canvas.getContext('webgl2', WEBGL_ATTRIBUTES) as
WebGLRenderingContext;\n }\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DataId, DataType, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nexport enum
PackingScheme {\n /**\n * All values in a single texel are densely packed without any constraints.\n *\n * This
is how the shader encodes a tensor with shape = [2, 3, 4]\n * (indices are [batch, row, col]).\n *\n * 000|001
010|011 020|021\n * -----\n * 002|003 012|013 022|023\n *\n * 100|101 110|111 120|121\n * -----\n * 102|103 112|113 122|123\n *\n *\n * DENSE,\n *\n /**\n * Single texels contain only values from the same batch, and from adjacent\n * rows and
columns.\n *\n * This is how the shader encodes a tensor with shape = [2, 3, 5]\n * (indices are [batch, row,
col]).\n *\n * 000|001 002|003 004|xxx 020|021 022|023 024|xxx\n * -----\n * 010|011 012|013 014|xxx xxx|xxx xxx|xxx xxx|xxx\n *\n * 100|101 102|103 104|xxx
120|121 122|123 124|xxx\n * -----\n * 110|111 112|113 114|xxx
xxx|xxx xxx|xxx xxx|xxx\n *\n *\n * SHARED_BATCH\n *}\n\nexport enum TextureUsage {\n RENDER,\n UPLOAD,\n PIXELS,\n DOWNLOAD\n *}\n\nexport enum PhysicalTextureType {\n UNPACKED_FLOAT16,\n UNPACKED_FLOAT32,\n PACKED_4X1_UNSIGNED_BYTE,\n PACKED_2X2_FLOAT32,\n PACKED_2X2_FLOAT16\n *}\n\nexport
interface TextureData {\n // Required.\n shape: number[];\n dtype: DataType;\n\n // Optional.\n values?:
backend_util.BackendValues;\n texture?: WebGLTexture;\n // For complex numbers, the real and imaginary parts
are stored as their own\n // individual tensorInfos, with a parent joining the two with the\n // complexTensors field.
When this is defined, texture will be null.\n complexTensorInfos?: {real: TensorInfo, imag: TensorInfo};\n /**
[rows, columns] shape of the texture. *\n texShape?: [number, number];\n usage?: TextureUsage;\n isPacked?:
boolean;\n\n refCount: number;\n\n // Available when the tensor has been sliced.\n slice?: {\n // Offset in the 'flat
index' space.\n flatOffset: number;\n // Used for counting how many sliced tensors point to the same texture.\n
origDataId: DataId;\n };\n}\n\nexport function getUnpackedMatrixTextureShapeWidthHeight(\n rows: number,
columns: number): [number, number] {\n return [columns,
rows];\n}\n\nexport function getUnpackedArraySizeFromMatrixSize(\n matrixSize: number, channelsPerTexture:
number): number {\n return matrixSize * channelsPerTexture;\n}\n\nexport function
getColorMatrixTextureShapeWidthHeight(\n rows: number, columns: number): [number, number] {\n return
[columns * 4, rows];\n}\n\n/**\n * Get shape for densely packed RGBA texture.\n *}\n\nexport function
getDenseTexShape(shape: number[]): [number, number] {\n const size = util.sizeFromShape(shape);\n const
texelsNeeded = Math.ceil(size / 4);\n return util.sizeToSquarishShape(texelsNeeded);\n}\n\nexport function
getMatrixSizeFromUnpackedArraySize(\n unpackedSize: number, channelsPerTexture: number): number {\n if

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(unpackedSize % channelsPerTexture !== 0) {\n throw new Error(\n `unpackedSize (${unpackedSize}) must
be a multiple of ` +\n `${channelsPerTexture}`);\n }
\n return unpackedSize / channelsPerTexture;\n}\n\nexport
function decodeMatrixFromUnpackedColorRGBAArray(\n
 unpackedArray: Float32Array, matrix: Float32Array, channels: number) {\n const requiredSize =
unpackedArray.length * channels / 4;\n if (matrix.length < requiredSize) {\n throw new Error(\n `matrix
length (${matrix.length}) must be >= ${requiredSize}`);\n }\n let dst = 0;\n for (let src = 0; src <
unpackedArray.length; src += 4) {\n for (let c = 0; c < channels; c++) {\n matrix[dst++] = unpackedArray[src +
c];\n }\n }\n}\n\nexport function getPackedMatrixTextureShapeWidthHeight(\n rows: number, columns:
number): [number, number] {\n return [\n Math.max(1, Math.ceil(columns / 2)), Math.max(1, Math.ceil(rows /
2))\n];\n}\n\nexport function getPackedRGBAArraySizeFromMatrixShape(\n rows: number, columns: number):
number {\n const [w, h] = getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return w * h *
4;\n}\n\nexport interface TextureConfig {\n internalFormatFloat: number;\n textureFormatFloat: number;\n
internalFormatPackedHalfFloat:
number;\n internalFormatHalfFloat: number;\n internalFormatPackedFloat: number;\n\n // The format to use
during a gl.readPixels call.\n downloadTextureFormat: number;\n // How many channels need to be unpacked after
a gl.readPixels call.\n downloadUnpackNumChannels: number;\n\n defaultNumChannels: number;\n
textureTypeHalfFloat: number;\n textureTypeFloat: number;\n}\n\nexport function getTextureConfig(\n //
tslint:disable-next-line:no-any\n gl: WebGLRenderingContext, textureHalfFloatExtension?: any): TextureConfig
{\n // tslint:disable-next-line:no-any\n const glany = gl as any;\n\n let internalFormatFloat: number;\n let
internalFormatHalfFloat: number;\n let internalFormatPackedHalfFloat: number;\n let internalFormatPackedFloat:
number;\n let textureFormatFloat: number;\n\n let downloadTextureFormat: number;\n let
downloadUnpackNumChannels: number;\n\n let defaultNumChannels: number;\n let textureTypeHalfFloat:
number;\n let textureTypeFloat: number;\n\n if (env().getNumber('WEBGL_VERSION') === 2) {\n internalFormatFloat = glany.R32F;\n
internalFormatHalfFloat = glany.R16F;\n internalFormatPackedHalfFloat = glany.RGBA16F;\n
internalFormatPackedFloat = glany.RGBA32F;\n textureFormatFloat = glany.RED;\n
downloadUnpackNumChannels = 4;\n defaultNumChannels = 1;\n textureTypeHalfFloat =
glany.HALF_FLOAT;\n textureTypeFloat = glany.FLOAT;\n } else {\n internalFormatFloat = gl.RGBA;\n
internalFormatHalfFloat = gl.RGBA;\n internalFormatPackedHalfFloat = gl.RGBA;\n
internalFormatPackedFloat = glany.RGBA;\n textureFormatFloat = gl.RGBA;\n downloadUnpackNumChannels
= 4;\n defaultNumChannels = 4;\n textureTypeHalfFloat = textureHalfFloatExtension != null ?\n
textureHalfFloatExtension.HALF_FLOAT_OES :\n null;\n textureTypeFloat = gl.FLOAT;\n }\n\n downloadTextureFormat = gl.RGBA;\n\n return {\n internalFormatFloat,\n internalFormatHalfFloat,\n
internalFormatPackedHalfFloat,\n
internalFormatPackedFloat,\n textureFormatFloat,\n downloadTextureFormat,\n
downloadUnpackNumChannels,\n defaultNumChannels,\n textureTypeHalfFloat,\n textureTypeFloat\n };\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
\n *=====\n
*\n\nimport {env, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{getWebGLContext} from './canvas_util';\nimport {getTextureConfig} from './tex_util';\n\nexport function
callAndCheck<T>(gl: WebGLRenderingContext, func: () => T): T {\n const returnValue = func();\n if
(env().getBool('DEBUG')) {\n checkWebGLError(gl);\n }\n return returnValue;\n}\n\nfunction
checkWebGLError(gl: WebGLRenderingContext) {\n const error = gl.getError();\n if (error !== gl.NO_ERROR)

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{\n throw new Error('WebGL Error: ' + getWebGLErrorMessage(gl, error));\n }\n}\n\n//
https://en.wikipedia.org/wiki/Half-precision_floating-point_format\nconst MIN_FLOAT16 = 5.96e-8;\nconst
MAX_FLOAT16 = 65504;\n\nexport function canBeRepresented(num: number): boolean {\n if
(env().getBool('WEBGL_RENDER_FLOAT32_ENABLED') || num === 0 ||\n (MIN_FLOAT16 <
Math.abs(num) && Math.abs(num) < MAX_FLOAT16)) {\n return true;\n }\n return false;\n}\n\nexport
function getWebGLErrorMessage(\n gl: WebGLRenderingContext, status: number): string {\n switch (status) {\n
 case gl.NO_ERROR:\n return 'NO_ERROR';\n case gl.INVALID_ENUM:\n return
'INVALID_ENUM';\n case gl.INVALID_VALUE:\n return 'INVALID_VALUE';\n case
gl.INVALID_OPERATION:\n return 'INVALID_OPERATION';\n case
gl.INVALID_FRAMEBUFFER_OPERATION:\n return 'INVALID_FRAMEBUFFER_OPERATION';\n case
gl.OUT_OF_MEMORY:\n return 'OUT_OF_MEMORY';\n case gl.CONTEXT_LOST_WEBGL:\n return
'CONTEXT_LOST_WEBGL';\n default:\n return `Unknown error code ${status}`;\n }\n}\n\nexport function
getExtensionOrThrow(\n gl: WebGLRenderingContext, extensionName: string): {} {\n return
throwIfNull<{}>(\n gl, () => gl.getExtension(extensionName),\n 'Extension \'' + extensionName + '\' not
supported on this browser.);\n}\n\nexport function createVertexShader(\n gl: WebGLRenderingContext,
vertexShaderSource: string): WebGLShader {\n const vertexShader: WebGLShader =
throwIfNull<WebGLShader>(\n gl, () => gl.createShader(gl.VERTEX_SHADER),\n 'Unable to create vertex WebGLShader.);\n callAndCheck(gl, () => gl.shaderSource(vertexShader,
vertexShaderSource));\n callAndCheck(gl, () => gl.compileShader(vertexShader));\n if
(gl.getShaderParameter(vertexShader, gl.COMPILE_STATUS) === false) {\n
console.log(gl.getShaderInfoLog(vertexShader));\n throw new Error('Failed to compile vertex shader.);\n }\n
return vertexShader;\n}\n\nexport function createFragmentShader(\n gl: WebGLRenderingContext,
fragmentShaderSource: string): WebGLShader {\n const fragmentShader: WebGLShader =
throwIfNull<WebGLShader>(\n gl, () => gl.createShader(gl.FRAGMENT_SHADER),\n 'Unable to create
fragment WebGLShader.);\n callAndCheck(gl, () => gl.shaderSource(fragmentShader, fragmentShaderSource));\n
callAndCheck(gl, () => gl.compileShader(fragmentShader));\n if (gl.getShaderParameter(fragmentShader,
gl.COMPILE_STATUS) === false) {\n logShaderSourceAndInfoLog(\n fragmentShaderSource,
gl.getShaderInfoLog(fragmentShader));\n
throw new Error('Failed to compile fragment shader.);\n }\n return fragmentShader;\n}\n\nconst
lineNumberRegex = /ERROR: [0-9]+:([0-9]+)/g;\nfunction logShaderSourceAndInfoLog(\n shaderSource: string,
shaderInfoLog: string) {\n const lineNumberRegexResult = lineNumberRegex.exec(shaderInfoLog);\n if
(lineNumberRegexResult == null) {\n console.log(`Couldn't parse line number in error: ${shaderInfoLog}`);\n
console.log(shaderSource);\n return;\n }\n const lineNumber = +lineNumberRegexResult[1];\n const
shaderLines = shaderSource.split('\n');\n const pad = shaderLines.length.toString().length + 2;\n const
linesWithLineNumbers = shaderLines.map(\n (line, lineNumber) =>\n util.rightPad((lineNumber +
1).toString(), pad) + line);\n let maxLineLength = 0;\n for (let i = 0; i < linesWithLineNumbers.length; i++) {\n
maxLineLength = Math.max(linesWithLineNumbers[i].length, maxLineLength);\n }\n const beforeErrorLines =
linesWithLineNumbers.slice(0,
lineNumber - 1);\n const errorLine = linesWithLineNumbers.slice(lineNumber - 1, lineNumber);\n const
afterErrorLines = linesWithLineNumbers.slice(lineNumber);\n console.log(beforeErrorLines.join('\n'));\n
console.log(shaderInfoLog.split('\n')[0]);\n console.log(\n `%c ${util.rightPad(errorLine[0],
maxLineLength)} `,\n 'border: 1px solid red; background-color: #e3d2d2; color: #a61717');\n
console.log(afterErrorLines.join('\n'));\n}\n\nexport function createProgram(gl: WebGLRenderingContext):
WebGLProgram {\n return throwIfNull<WebGLProgram>(\n gl, () => gl.createProgram(), 'Unable to create
WebGLProgram.);\n}\n\nexport function linkProgram(gl: WebGLRenderingContext, program: WebGLProgram)
{\n callAndCheck(gl, () => gl.linkProgram(program));\n if (gl.getProgramParameter(program, gl.LINK_STATUS)
=== false) {\n console.log(gl.getProgramInfoLog(program));\n throw new Error('Failed to link vertex and
fragment shaders.);\n }\n}\n\nexport

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function validateProgram(\n gl: WebGLRenderingContext, program: WebGLProgram) {\n callAndCheck(gl, ()
=> gl.validateProgram(program));\n if (gl.getProgramParameter(program, gl.VALIDATE_STATUS) === false) {\n
 console.log(gl.getProgramInfoLog(program));\n throw new Error('Shader program validation failed.);\n
}\n}\n\n\nexport function createStaticVertexBuffer(\n gl: WebGLRenderingContext, data: Float32Array):
WebGLBuffer {\n const buffer: WebGLBuffer = throwIfNull<WebGLBuffer>(\n gl, () => gl.createBuffer(),
'Unable to create WebGLBuffer');\n callAndCheck(gl, () => gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n
callAndCheck(gl, () => gl.bufferData(gl.ARRAY_BUFFER, data, gl.STATIC_DRAW));\n return
buffer;\n}\n\n\nexport function createStaticIndexBuffer(\n gl: WebGLRenderingContext, data: Uint16Array):
WebGLBuffer {\n const buffer: WebGLBuffer = throwIfNull<WebGLBuffer>(\n gl, () => gl.createBuffer(),
'Unable to create WebGLBuffer');\n callAndCheck(gl, () => gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER,
buffer));\n callAndCheck(\n gl, () => gl.bufferData(gl.ELEMENT_ARRAY_BUFFER, data,
gl.STATIC_DRAW));\n return buffer;\n}\n\n\nexport function getNumChannels(): number {\n if
(env().getNumber('WEBGL_VERSION') === 2) {\n return 1;\n }\n return 4;\n}\n\n\nexport function
createTexture(gl: WebGLRenderingContext): WebGLTexture {\n return throwIfNull<WebGLTexture>(\n gl, ()
=> gl.createTexture(), 'Unable to create WebGLTexture.);\n}\n\n\nexport function validateTextureSize(width:
number, height: number) {\n const maxTextureSize = env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n if
((width <= 0) || (height <= 0)) {\n const requested = `${width}x${height}`;\n throw new Error('Requested
texture size ' + requested + ' is invalid.);\n }\n if ((width > maxTextureSize) || (height > maxTextureSize)) {\n
const requested = `${width}x${height}`;\n const max = `${maxTextureSize}x${maxTextureSize}`;\n throw
new Error(\n 'Requested
texture size ' + requested + '\n ' greater than WebGL maximum on this browser / GPU ' + max + '.);\n
}\n}\n\n\nexport function createFramebuffer(gl: WebGLRenderingContext): WebGLFramebuffer {\n return
throwIfNull<WebGLFramebuffer>(\n gl, () => gl.createFramebuffer(), 'Unable to create
WebGLFramebuffer.);\n}\n\n\nexport function bindVertexBufferToProgramAttribute(\n gl:
WebGLRenderingContext, program: WebGLProgram, attribute: string,\n buffer: WebGLBuffer,
arrayEntriesPerItem: number, itemStrideInBytes: number,\n itemOffsetInBytes: number): boolean {\n const loc =
gl.getAttribLocation(program, attribute);\n if (loc === -1) {\n // The GPU compiler decided to strip out this
attribute because it's unused,\n // thus no need to bind.\n return false;\n }\n callAndCheck(gl, () =>
gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n callAndCheck(\n gl,\n () => gl.vertexAttribPointer(\n
loc, arrayEntriesPerItem, gl.FLOAT, false, itemStrideInBytes,\n
itemOffsetInBytes));\n callAndCheck(gl, () => gl.enableVertexAttribArray(loc));\n return true;\n}\n\n\nexport
function bindTextureUnit(\n gl: WebGLRenderingContext, texture: WebGLTexture, textureUnit: number) {\n
validateTextureUnit(gl, textureUnit);\n callAndCheck(gl, () => gl.activeTexture(gl.TEXTURE0 + textureUnit));\n
callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n}\n\n\nexport function unbindTextureUnit(\n
gl: WebGLRenderingContext, textureUnit: number) {\n validateTextureUnit(gl, textureUnit);\n callAndCheck(gl,
() => gl.activeTexture(gl.TEXTURE0 + textureUnit));\n callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,
null));\n}\n\n\nexport function getProgramUniformLocationOrThrow(\n gl: WebGLRenderingContext, program:
WebGLProgram,\n uniformName: string): WebGLUniformLocation {\n return
throwIfNull<WebGLUniformLocation>(\n gl, () => gl.getUniformLocation(program, uniformName),\n
'uniform \'' + uniformName + '\'' not present in
program.);\n}\n\n\nexport function getProgramUniformLocation(\n gl: WebGLRenderingContext, program:
WebGLProgram,\n uniformName: string): WebGLUniformLocation {\n return gl.getUniformLocation(program,
uniformName);\n}\n\n\nexport function bindTextureToProgramUniformSampler(\n gl: WebGLRenderingContext,
texture: WebGLTexture,\n uniformSamplerLocation: WebGLUniformLocation, textureUnit: number) {\n
callAndCheck(gl, () => bindTextureUnit(gl, texture, textureUnit));\n callAndCheck(gl, () =>
gl.uniform1i(uniformSamplerLocation, textureUnit);\n}\n\n\nexport function bindCanvasToFramebuffer(gl:
WebGLRenderingContext) {\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, null));\n
callAndCheck(gl, () => gl.viewport(0, 0, gl.canvas.width, gl.canvas.height));\n callAndCheck(gl, () => gl.scissor(0,

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0, gl.canvas.width, gl.canvas.height));\n}\n\nexport function bindColorTextureToFramebuffer(\n gl:
WebGLRenderingContext, texture: WebGLTexture,\n framebuffer: WebGLFramebuffer)
{\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer));\n callAndCheck(\n gl,\n () => gl.framebufferTexture2D(\n gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D,
texture, 0));\n}\n\nexport function unbindColorTextureFromFramebuffer(\n gl: WebGLRenderingContext,
framebuffer: WebGLFramebuffer) {\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER,
framebuffer));\n callAndCheck(\n gl,\n () => gl.framebufferTexture2D(\n gl.FRAMEBUFFER,
gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, null, 0));\n}\n\nexport function validateFramebuffer(gl:
WebGLRenderingContext) {\n const status = gl.checkFramebufferStatus(gl.FRAMEBUFFER);\n if (status !==
gl.FRAMEBUFFER_COMPLETE) {\n throw new Error(\n 'Error binding framebuffer: ' +
getFramebufferErrorMessage(gl, status));\n }\n}\n\nexport function getFramebufferErrorMessage(\n gl:
WebGLRenderingContext, status: number): string {\n switch (status) {\n case
gl.FRAMEBUFFER_INCOMPLETE_ATTACHMENT:\n return 'FRAMEBUFFER_INCOMPLETE_ATTACHMENT';\n case
gl.FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT:\n return
'FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT';\n case
gl.FRAMEBUFFER_INCOMPLETE_DIMENSIONS:\n return
'FRAMEBUFFER_INCOMPLETE_DIMENSIONS';\n case gl.FRAMEBUFFER_UNSUPPORTED:\n return
'FRAMEBUFFER_UNSUPPORTED';\n default:\n return `unknown error ${status}`;\n }\n}\n\nfunction
throwIfNull<T>(\n gl: WebGLRenderingContext, returnOrNull: () => T | null,\n failureMessage: string): T {\n
const tOrNull: T | null = callAndCheck(gl, () => returnOrNull());\n if (tOrNull === null) {\n throw new
Error(failureMessage);\n }\n return tOrNull;\n}\n\nfunction validateTextureUnit(gl: WebGLRenderingContext,
textureUnit: number) {\n const maxTextureUnit = gl.MAX_COMBINED_TEXTURE_IMAGE_UNITS - 1;\n const
glTextureUnit = textureUnit + gl.TEXTURE0;\n if (glTextureUnit < gl.TEXTURE0 || glTextureUnit >
maxTextureUnit) {\n const
textureUnitRange = `[gl.TEXTURE0, gl.TEXTURE${maxTextureUnit}]`;\n throw new Error(`textureUnit must
be in ${textureUnitRange}`);\n }\n}\n\nexport function getBatchDim(shape: number[], dimsToSkip = 2): number
{\n return util.sizeFromShape(shape.slice(0, shape.length - dimsToSkip));\n}\n\nexport function
getRowsCols(shape: number[]): [number, number] {\n if (shape.length === 0) {\n throw Error('Cannot get rows
and columns of an empty shape array.);\n }\n return [\n shape.length > 1 ? shape[shape.length - 2] : 1,
shape[shape.length - 1]\n];\n}\n\nexport function getShapeAs3D(shape: number[]): [number, number, number] {\n
let shapeAs3D: [number, number, number] = [1, 1, 1];\n const isScalar = shape.length === 0 || (shape.length === 1
&& shape[0] === 1);\n if (!isScalar) {\n shapeAs3D =\n [getBatchDim(shape), ...getRowsCols(shape)] as
[number, number, number];\n }\n return shapeAs3D;\n}\n\nexport function getTextureShapeFromLogicalShape(\n
logShape:
number[], isPacked = false): [number, number] {\n let maxTexSize =
env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n if (isPacked) {\n maxTexSize = maxTexSize * 2;\n\n
// This logic ensures we accurately count the number of packed texels needed\n // to accommodate the tensor. We
can only pack values in the same texel if\n // they are from adjacent pairs of rows/cols within the same batch. So if
a\n // tensor has 3 rows, we pretend it has 4 rows in order to account for the\n // fact that the texels containing the
third row are half empty.\n logShape = logShape.map(\n (d, i) => i >= logShape.length - 2 ?\n
util.nearestLargerEven(logShape[i]) :\n logShape[i]);\n\n // Packed texture height is at least 2 (the channel
height of a single\n // texel).\n if (logShape.length === 1) {\n logShape = [2, logShape[0]];
}\n }\n\n // If logical shape is 2, we don't squeeze, since we want to match physical.\n if (logShape.length !==
2) {\n const squeezeResult = util.squeezeShape(logShape);\n logShape = squeezeResult.newShape;\n }\n\n let
size = util.sizeFromShape(logShape);\n if (logShape.length <= 1 && size <= maxTexSize) {\n return [1, size];\n
} else if (\n logShape.length === 2 && logShape[0] <= maxTexSize &&\n logShape[1] <= maxTexSize) {\n
return logShape as [number, number];\n } else if (\n logShape.length === 3 && logShape[0] * logShape[1] <=

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maxTexSize &&\n logShape[2] <= maxTexSize) {\n return [logShape[0] * logShape[1], logShape[2]];\n } else
if (\n logShape.length === 3 && logShape[0] <= maxTexSize &&\n logShape[1] * logShape[2] <=
maxTexSize) {\n return [logShape[0], logShape[1] * logShape[2]];\n } else if (\n logShape.length === 4 &&\n
 logShape[0] * logShape[1] * logShape[2] <= maxTexSize &&\n logShape[3] <= maxTexSize) {\n return
[logShape[0] * logShape[1] * logShape[2], logShape[3]];\n } else if (\n logShape.length === 4
&& logShape[0] <= maxTexSize &&\n logShape[1] * logShape[2] * logShape[3] <= maxTexSize) {\n return
[logShape[0], logShape[1] * logShape[2] * logShape[3]];\n } else {\n if (isPacked) {\n // For packed textures
size equals the number of channels required to\n // accommodate the texture data. However in order to squarify
such that\n // inner dimensions stay even, we rewrite size to equal the number of\n // texels. Then in the return
statement we rehydrate the squarified\n // dimensions to channel units.\n\n const batchDim =
getBatchDim(logShape);\n let rows = 2, cols = 2;\n if (logShape.length) {\n [rows, cols] =
getRowsCols(logShape);\n }\n size = batchDim * (rows / 2) * (cols / 2);\n return
util.sizeToSquarishShape(size).map(d => d * 2) as [number, number];\n }\n return
util.sizeToSquarishShape(size);\n }\n}\n\nfunction isEven(n: number): boolean {\n return n % 2 ===
0;\n}\n\n/**\n * This determines whether
reshaping a packed texture requires rearranging\n * the data within the texture, assuming 2x2 packing.\n */\n\nexport
function isReshapeFree(shape1: number[], shape2: number[]): boolean {\n shape1 = shape1.slice(-2);\n shape2 =
shape2.slice(-2);\n\n if (util.arraysEqual(shape1, shape2)) {\n return true;\n }\n\n if (!shape1.length ||
!shape2.length) { // One of the shapes is a scalar.\n return true;\n }\n\n if (shape1[0] === 0 || shape1[1] === 0 ||
shape2[0] === 0 ||\n shape2[1] === 0) {\n return true;\n }\n\n if (shape1.length !== shape2.length) { // One of
the shapes is a vector.\n const shape1Cols = shape1.slice(-1)[0];\n const shape2Cols = shape2.slice(-1)[0];\n if
(shape1Cols === shape2Cols) {\n return true;\n }\n\n if (isEven(shape1Cols) && isEven(shape2Cols) &&\n
 (shape1[0] === 1 || shape2[0] === 1)) {\n return true;\n }\n }\n return shape1[1] === shape2[1] &&
isEven(shape1[0]) && isEven(shape2[0]);\n}\n\n// We cache
webgl params because the environment gets reset between\n// unit tests and we don't want to constantly query the
WebGLContext for\n// MAX_TEXTURE_SIZE.\n\nlet MAX_TEXTURE_SIZE: number;\n\nlet
MAX_TEXTURES_IN_SHADER: number;\n\nexport function getWebGLMaxTextureSize(webGLVersion:
number): number {\n if (MAX_TEXTURE_SIZE === null) {\n const gl = getWebGLContext(webGLVersion);\n\n MAX_TEXTURE_SIZE = gl.getParameter(gl.MAX_TEXTURE_SIZE);\n }\n return
MAX_TEXTURE_SIZE;\n}\n\nexport function resetMaxTextureSize() {\n MAX_TEXTURE_SIZE =
null;\n}\n\nexport function resetMaxTexturesInShader() {\n MAX_TEXTURES_IN_SHADER = null;\n}\n\nexport
function getMaxTexturesInShader(webGLVersion: number): number {\n if (MAX_TEXTURES_IN_SHADER ===
null) {\n const gl = getWebGLContext(webGLVersion);\n MAX_TEXTURES_IN_SHADER =
gl.getParameter(gl.MAX_TEXTURE_IMAGE_UNITS);\n }\n // We cap at 16 to avoid spurious runtime \"memory
exhausted\" error.\n return Math.min(16, MAX_TEXTURES_IN_SHADER);\n}\n\nexport
function getWebGLDisjointQueryTimerVersion(webGLVersion: number):\n number {\n if (webGLVersion ===
0) {\n return 0;\n }\n\n let queryTimerVersion: number;\n const gl = getWebGLContext(webGLVersion);\n\n if
(hasExtension(gl, 'EXT_disjoint_timer_query_webgl2') &&\n webGLVersion === 2) {\n queryTimerVersion =
2;\n } else if (hasExtension(gl, 'EXT_disjoint_timer_query')) {\n queryTimerVersion = 1;\n } else {\n
queryTimerVersion = 0;\n }\n return queryTimerVersion;\n}\n\nexport function hasExtension(gl:
WebGLRenderingContext, extensionName: string) {\n const ext = gl.getExtension(extensionName);\n return ext !=
null;\n}\n\nexport function isWebGLVersionEnabled(webGLVersion: 1|2) {\n try {\n const gl =
getWebGLContext(webGLVersion);\n if (gl != null) {\n return true;\n }\n } catch (e) {\n console.log('Error
when getting WebGL context: ', e);\n return false;\n }\n return false;\n}\n\nexport function
isCapableOfRenderingToFloatTexture(webGLVersion:
number):\n boolean {\n if (webGLVersion === 0) {\n return false;\n }\n\n const gl =
getWebGLContext(webGLVersion);\n\n if (webGLVersion === 1) {\n if (!hasExtension(gl, 'OES_texture_float'))
{\n return false;\n }\n } else {\n if (!hasExtension(gl, 'EXT_color_buffer_float')) {\n return false;\n }\n
}

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}\n\n const isFramebufferComplete = createFloatTextureAndBindToFramebuffer(gl);\n return
isFramebufferComplete;\n}\n\n/**\n * Check if we can download values from a float/half-float texture.\n *\n * Note that for performance reasons we use binding a texture to a framebuffer\n * as a proxy for ability to download float values later using readPixels. The\n * texture params of this texture will not match those in readPixels exactly\n * but if we are unable to bind some kind of float texture to the framebuffer\n * then we definitely will not be able to read float values from it.\n */\nexport function isDownloadFloatTextureEnabled(webGLVersion:
number): boolean {\n if (webGLVersion === 0) {\n return false;\n }\n\n const gl =
getWebGLContext(webGLVersion);\n\n if (webGLVersion === 1) {\n if (!hasExtension(gl, 'OES_texture_float'))
{\n return false;\n }\n if (!hasExtension(gl, 'WEBGL_color_buffer_float')) {\n return false;\n }\n } else
{\n if (hasExtension(gl, 'EXT_color_buffer_float')) {\n return createFloatTextureAndBindToFramebuffer(gl);\n
}\n\n const COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n if (hasExtension(gl,
COLOR_BUFFER_HALF_FLOAT)) {\n const textureHalfFloatExtension =\n
gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n return
createHalfFloatTextureAndBindToFramebuffer(\n gl, textureHalfFloatExtension);\n }\n\n return false;\n
}\n\n const isFramebufferComplete = createFloatTextureAndBindToFramebuffer(gl);\n return
isFramebufferComplete;\n}\n\nfunction createFloatTextureAndBindToFramebuffer(gl:
WebGLRenderingContext):\n
boolean {\n const texConfig = getTextureConfig(gl);\n const texture = gl.createTexture();\n
gl.bindTexture(gl.TEXTURE_2D, texture);\n\n const width = 1;\n const height = 1;\n gl.texImage2D(\n
gl.TEXTURE_2D, 0, texConfig.internalFormatFloat, width, height, 0,\n texConfig.textureFormatFloat,
texConfig.textureTypeFloat, null);\n\n const framebuffer = gl.createFramebuffer();\n
gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer);\n gl.framebufferTexture2D(\n gl.FRAMEBUFFER,
gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);\n\n const isFramebufferComplete =\n
gl.checkFramebufferStatus(gl.FRAMEBUFFER) === gl.FRAMEBUFFER_COMPLETE;\n\n
gl.bindTexture(gl.TEXTURE_2D, null);\n gl.bindFramebuffer(gl.FRAMEBUFFER, null);\n
gl.deleteTexture(texture);\n gl.deleteFramebuffer(framebuffer);\n\n return isFramebufferComplete;\n}\n\nfunction
createHalfFloatTextureAndBindToFramebuffer(\n // tslint:disable-next-line:no-any\n gl:
WebGLRenderingContext, textureHalfFloatExtension:
any): boolean {\n const texConfig = getTextureConfig(gl, textureHalfFloatExtension);\n const texture =
gl.createTexture();\n gl.bindTexture(gl.TEXTURE_2D, texture);\n\n const width = 1;\n const height = 1;\n
gl.texImage2D(\n gl.TEXTURE_2D, 0, texConfig.internalFormatHalfFloat, width, height, 0,\n
texConfig.textureFormatFloat, texConfig.textureTypeHalfFloat, null);\n\n const framebuffer =
gl.createFramebuffer();\n gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer);\n gl.framebufferTexture2D(\n
gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);\n\n const
isFramebufferComplete =\n gl.checkFramebufferStatus(gl.FRAMEBUFFER) ===
gl.FRAMEBUFFER_COMPLETE;\n\n gl.bindTexture(gl.TEXTURE_2D, null);\n
gl.bindFramebuffer(gl.FRAMEBUFFER, null);\n gl.deleteTexture(texture);\n
gl.deleteFramebuffer(framebuffer);\n\n return isFramebufferComplete;\n}\n\nexport function
isWebGLFenceEnabled(webGLVersion: number) {\n if (webGLVersion !== 2) {\n return
false;\n }\n\n const gl = getWebGLContext(webGLVersion);\n\n // tslint:disable-next-line:no-any\n const
isEnabled = (gl as any).fenceSync !== null;\n return isEnabled;\n}\n\nexport function assertNotComplex(\n tensor:
TensorInfo|TensorInfo[], opName: string): void {\n if (!Array.isArray(tensor)) {\n tensor = [tensor];\n }\n
tensor.forEach(t => {\n if (t !== null) {\n util.assert(\n t.dtype !== 'complex64',\n () => `${opName}
does not support complex64 tensors` +\n 'in the WebGL backend.);\n }\n });\n}\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an

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"AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
=====
import {device_util, env} from '@tensorflow/tfjs-core';
import {getMaxTexturesInShader,
getWebGLDisjointQueryTimerVersion, getWebGLMaxTextureSize, isCapableOfRenderingToFloatTexture,
isDownloadFloatTextureEnabled, isWebGLFenceEnabled, isWebGLVersionEnabled} from './webgl_util';
const
ENV = env();
 * This file contains WebGL-specific flag registrations.
 * True if WebGL is supported.
ENV.registerFlag('HAS_WEBGL', () => ENV.getNumber('WEBGL_VERSION') > 0);
 0: No WebGL, 1: WebGL 1.0, 2: WebGL 2.0.
ENV.registerFlag('WEBGL_VERSION', () => {
 if (isWebGLVersionEnabled(2)) {
 return 2;
 } else if (isWebGLVersionEnabled(1)) {
 return 1;
 }
 return 0;
});
 * Whether to check for numerical representation problems.
ENV.registerFlag('WEBGL_CHECK_NUMERICAL_PROBLEMS', () => false);
ENV.registerFlag('WEBGL_BUFFER_SUPPORTED', () => ENV.get('WEBGL_VERSION') === 2);
 * Whether the WebGL backend will sometimes forward ops to the CPU.
ENV.registerFlag('WEBGL_CPU_FORWARD', () => true);
 * Whether the WebGL backend will always use f16 textures for rendering.
ENV.registerFlag('WEBGL_FORCE_F16_TEXTURES', () => false);
 * Whether to turn all packing related flags on.
ENV.registerFlag('WEBGL_PACK', () => ENV.getBool('HAS_WEBGL'));
 * Whether we will pack the batchnormalization op.
ENV.registerFlag('WEBGL_PACK_NORMALIZATION', () => ENV.getBool('WEBGL_PACK'));
 * Whether we will pack the clip op.
ENV.registerFlag('WEBGL_PACK_CLIP', () => ENV.getBool('WEBGL_PACK'));
 * Whether we will pack the depthwise conv op.
// TODO:
https://github.com/tensorflow/tfjs/issues/1679
ENV.registerFlag('WEBGL_PACK_DEPTHWISECONV', () => false);
 * Whether we will pack binary ops.
ENV.registerFlag('WEBGL_PACK_BINARY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));
 * Whether we will pack unary ops.
ENV.registerFlag('WEBGL_PACK_UNARY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));
 * Whether we will pack array ops.
ENV.registerFlag('WEBGL_PACK_ARRAY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));
 * Whether we will pack image ops.
ENV.registerFlag('WEBGL_PACK_IMAGE_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));
 * Whether we will pack reduce ops.
ENV.registerFlag('WEBGL_PACK_REDUCE', () => ENV.getBool('WEBGL_PACK'));
 * Whether packed WebGL kernels lazily unpack their outputs.
ENV.registerFlag('WEBGL_LAZILY_UNPACK', () => ENV.getBool('WEBGL_PACK'));
 * Whether we will use the im2col algorithm to speed up convolutions.
ENV.registerFlag('WEBGL_CONV_IM2COL', () => ENV.getBool('WEBGL_PACK'));
 * The maximum texture dimension.
ENV.registerFlag('WEBGL_MAX_TEXTURE_SIZE', () => getWebGLMaxTextureSize(ENV.getNumber('WEBGL_VERSION')));
 * The maximum texture dimension.
ENV.registerFlag('WEBGL_MAX_TEXTURES_IN_SHADER', () => getMaxTexturesInShader(ENV.getNumber('WEBGL_VERSION')));
 * The disjoint_query_timer extension version.
 0: disabled, 1: EXT_disjoint_timer_query, 2: EXT_disjoint_timer_query_webgl2.
 * In Firefox with WebGL 2.0, EXT_disjoint_timer_query_webgl2 is not available, so we must use the WebGL 1.0 extension.
ENV.registerFlag('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION', () => {
 const webGLVersion = ENV.getNumber('WEBGL_VERSION');
 if (webGLVersion === 0) {
 return 0;
 }
 return getWebGLDisjointQueryTimerVersion(webGLVersion);
});
 * Whether the timer object from the disjoint_query_timer extension gives timing information that is reliable.
ENV.registerFlag('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE', () => ENV.getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0 && !device_util.isMobile());
 * Whether the device is physically capable of rendering to float32 textures.
ENV.registerFlag('WEBGL_RENDER_FLOAT32_CAPABLE', () =>

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isCapableOfRenderingToFloatTexture(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Whether rendering to
float32 textures is enabled. If disabled, renders to\n * float16 textures.\n
*\nENV.registerFlag('WEBGL_RENDER_FLOAT32_ENABLED', () => {\n return
ENV.getBool('WEBGL_FORCE_F16_TEXTURES') ?\n false :\n
ENV.getBool('WEBGL_RENDER_FLOAT32_CAPABLE');\n});\n\n/**\n * Whether downloading float textures is
enabled (16 or 32 bit). If disabled,\n * uses IEEE 754 encoding of the float32 values to 4 uint8 when downloading.\n
*\nENV.registerFlag(\n 'WEBGL_DOWNLOAD_FLOAT_ENABLED',\n () =>
isDownloadFloatTextureEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Whether the fence API is
available.
*\nENV.registerFlag(\n 'WEBGL_FENCE_API_ENABLED',\n () =>
isWebGLFenceEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Tensors with size <= than this will be
uploaded as uniforms, not textures.\n *\nENV.registerFlag('WEBGL_SIZE_UPLOAD_UNIFORM', () => {\n //
Use uniform uploads only when 32bit floats are supported. In\n // 16bit\n // environments there are problems with
comparing a 16bit texture value\n // with a 32bit uniform value.\n const useUniforms =
ENV.getBool('WEBGL_RENDER_FLOAT32_ENABLED');\n return useUniforms ? 4 : 0;\n});\n\n/**\n * If the
total number of bytes allocated on the GPU is greater than this\n * number, we will aggressively delete textures
upon disposal with\n * gl.deleteMatrixTexture, rather than making them available for reuse.\n *\n * Default value -1
indicates that we will never aggressively delete textures.\n *\nENV.registerFlag(\n
'WEBGL_DELETE_TEXTURE_THRESHOLD',\n () => {\n return -1;\n },\n threshold => {\n if
(threshold
< 0 && threshold !== -1) {\n throw new Error(\n `WEBGL_DELETE_TEXTURE_THRESHOLD must
be -1 (indicating never ` +\n `delete) or at least 0, but got ${threshold}.`);\n };\n });\n\n"}\n\n
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=====\n\n
*\nimport {env} from '@tensorflow/tfjs-core';\n\nexport
type GLSL = {\n version: string,\n attribute: string,\n varyingVs: string,\n varyingFs: string,\n texture2D:
string,\n output: string,\n defineOutput: string,\n defineSpecialNaN: string,\n defineSpecialInf: string,\n
defineRound: string;\n};\n\nexport function getGlsIDifferences(): GLSL {\n let version: string;\n let attribute:
string;\n let varyingVs: string;\n let varyingFs: string;\n let texture2D: string;\n let output: string;\n let
defineOutput: string;\n let defineSpecialNaN: string;\n let defineSpecialInf: string;\n let defineRound: string;\n
if (env().getNumber('WEBGL_VERSION') === 2) {\n version = '#version 300 es';\n attribute = 'in';\n
varyingVs = 'out';\n varyingFs = 'in';\n texture2D = 'texture';\n output = 'outputColor';\n defineOutput = 'out
vec4 outputColor';\n\n // Use custom isnan definition to work across differences between\n // implementations
on various platforms. While this should happen in ANGLE\n // we still
see differences between android and windows (on chrome) when\n // using isnan directly.\n defineSpecialNaN
= `\n bool isnan_custom(float val) {\n return (val > 0.0 || val < 0.0) ? false : val !== 0.0;\n }\n\n bvec4
isnan_custom(vec4 val) {\n return bvec4(isnan_custom(val.x),\n isnan_custom(val.y),
isnan_custom(val.z), isnan_custom(val.w));\n }\n\n #define isnan(value) isnan_custom(value)\n `;\n // In
webgl 2 we do not need to specify a custom isinf so there is no\n // need for a special INFINITY constant.\n
defineSpecialInf = `;\n defineRound = `\n #define round(value) newRound(value)\n int newRound(float
value) {\n return int(floor(value + 0.5));\n }\n\n ivec4 newRound(vec4 value) {\n return
ivec4(floor(value + vec4(0.5)));\n }\n `;\n } else {\n version = ";\n attribute = 'attribute';\n varyingVs =
'varying';\n varyingFs = 'varying';\n texture2D = 'texture2D';\n

```

```

 output = 'gl_FragColor';\n defineOutput = '';\n // WebGL1 has no built in isnan so we define one here.\n defineSpecialNaN = `\n #define isnan(value) isnan_custom(value)\n bool isnan_custom(float val) {\n return (val > 0. || val < 1. || val == 0.) ? false : true;\n }\n bvec4 isnan_custom(vec4 val) {\n return\n bvec4(isnan(val.x), isnan(val.y), isnan(val.z), isnan(val.w));\n }\n `;\n defineSpecialInf = `\n uniform float\n INFINITY;\n\n bool isinf(float val) {\n return abs(val) == INFINITY;\n }\n bvec4 isinf(vec4 val) {\n return equal(abs(val), vec4(INFINITY));\n }\n `;\n defineRound = `\n int round(float value) {\n return int(floor(value + 0.5));\n }\n\n ivec4 round(vec4 value) {\n return ivec4(floor(value +\n vec4(0.5)));\n }\n `;\n }\n\n return {\n version,\n attribute,\n varyingVs,\n varyingFs,\n texture2D,\n output,\n defineOutput,\n\n defineSpecialNaN,\n defineSpecialInf,\n defineRound\n };\n}\n"/**\n * @license\n * Copyright 2018\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {util} from '@tensorflow/tfjs-core';\n\n/**\n * Produces GLSL code that derives logical coordinates\n * from a flat\n * index. The code performs integer division with each stride and decrements\n * the index until the index equals the final dimension coordinate.\n */\n\nexport function\ngetLogicalCoordinatesFromFlatIndex(\n coords: string[], shape: number[], index = 'index'): string {\n const\n strides = util.computeStrides(shape);\n return strides\n .map((stride, i) => {\n const line1 = `int ${coords[i]}\n = ${index} / ${stride}`;\n const line2 = i === strides.length - 1 ?\n `int ${coords[i + 1]} = ${index} -\n ${coords[i]} * ${stride}`\n : `index -= ${coords[i]} * ${stride}`;\n return `${line1}; ${line2};`;\n })\n .join(");\n\n\nfunction buildVec(x: string[]): string {\n if (x.length === 1) {\n return `${x[0]}`;\n }\n return\n `vec${x.length}(${x.join(',')}`);\n}\n\n/**\n * Produces GLSL code that computes the dot product of the input x and\n * y\n * vectors. Handles splitting inputs into increments of vec4s when necessary.\n */\n\nexport function dotify(x:\nstring[], y: string[]): string {\n if (x.length !== y.length)\n {\n throw new Error(`\n Vectors to be dotted must be of the same length -\n got ${x.length} and\n ${y.length}`);\n }\n\n const slices: string[] = [];\n const nearestVec4 = Math.floor(x.length / 4);\n const\n nearestVec4Remainder = x.length % 4;\n\n for (let i = 0; i < nearestVec4; i++) {\n const xSlice = x.slice(i * 4, i *\n 4 + 4);\n const ySlice = y.slice(i * 4, i * 4 + 4);\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n if (nearestVec4Remainder !== 0) {\n let xSlice = x.slice(nearestVec4 * 4);\n let ySlice =\n y.slice(nearestVec4 * 4);\n if (xSlice.length === 1) {\n xSlice = xSlice.map(d => `float(${d})`);\n ySlice =\n ySlice.map(d => `float(${d})`);\n }\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n return\n slices.map((d, i) => `dot(${d})`).join('+');\n}\n\n/**\n * Produces GLSL that computes the flat index from 3D\n * coordinates.\n */\n\nexport function getFlatIndexFrom3D(shape: [number, number,\n number]): string {\n const strides = util.computeStrides(shape).map(d => d.toString());\n\n return `\n int\n getFlatIndex(ivec3 coords) {\n return coords.x * ${strides[0]} + coords.y * ${strides[1]} + coords.z;\n }\n `;\n}\n\nexport const ENCODE_FLOAT_SNIPPET = `\n const float FLOAT_MAX = 1.70141184e38;\n const\n float FLOAT_MIN = 1.17549435e-38;\n\n lowp vec4 encode_float(highp float v) {\n if (isnan(v)) {\n return\n vec4(255, 255, 255, 255);\n }\n\n highp float av = abs(v);\n\n if (av < FLOAT_MIN) {\n return vec4(0.0,\n 0.0, 0.0, 0.0);\n }\n else if (v > FLOAT_MAX) {\n return vec4(0.0, 0.0, 128.0, 127.0) / 255.0;\n }\n else if (v < -\n FLOAT_MAX) {\n return vec4(0.0, 0.0, 128.0, 255.0) / 255.0;\n }\n\n highp vec4 c = vec4(0.0, 0.0, 0);\n\n highp float e = floor(log2(av));\n highp float m = exp2(fract(log2(av))) - 1.0;\n\n c[2] = floor(128.0 * m);\n m =\n = c[2] / 128.0;\n c[1] = floor(32768.0 * m);\n m =\n = c[1] / 32768.0;\n c[0] =\n floor(8388608.0 * m);\n\n highp float ebias = e + 127.0;\n c[3] = floor(ebias / 2.0);\n ebias =\n = c[3] * 2.0;\n c[2] += floor(ebias) * 128.0;\n c[3] += 128.0 * step(0.0, -v);\n\n return c / 255.0;\n }\n `;\n"/**\n *

```

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```
=====\n*\n\nimport {getGlsIDifferences} from './gls_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from './shader_compiler_util';\nimport {getDenseTexShape, PackingScheme} from './tex_util';\n\nexport class DecodeMatrixProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: [number, number, number];\n packedInputs = false;\n packedOutput = true;\n outPackingScheme = PackingScheme.DENSE;\n\n constructor(outputShape: [number, number, number]) {\n const texShape = getDenseTexShape(outputShape);\n const glsl = getGlsIDifferences();\n this.outputShape = outputShape;\n\n this.userCode = `\n ivec3\n outCoordsFromFlatIndex(int index) {\n ${\n shader_util.getLogicalCoordinatesFromFlatIndex(\n [r', 'c', 'd'], outputShape)\n }\n return ivec3(r, c, d);\n }\n\n void main() {\n ivec2 resTexRC =\n ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n int index = 4 * (resTexRC.x *\n ${texShape[1]} +\n resTexRC.y);\n ivec4 result = vec4(0);\n for (int i=0; i<4; i++) {\n int flatIndex = index + i;\n ivec3 rc = outCoordsFromFlatIndex(flatIndex);\n result[i] = getA(rc.x, rc.y, rc.z);\n }\n ${glsl.output} = result;\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {getGlsIDifferences} from './gls_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from './shader_compiler_util';\nimport {getDenseTexShape, PackingScheme} from './tex_util';\n\nexport class DecodeMatrixPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n outputShape: [number, number, number];\n outPackingScheme = PackingScheme.DENSE;\n\n constructor(outputShape: [number, number, number]) {\n const texShape = getDenseTexShape(outputShape);\n const glsl = getGlsIDifferences();\n this.outputShape = outputShape;\n\n this.userCode = `\n ivec3\n outCoordsFromFlatIndex(int index) {\n ${\n shader_util.getLogicalCoordinatesFromFlatIndex(\n [r', 'c', 'd'], outputShape)\n }\n return ivec3(r, c, d);\n }\n\n void main() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]},\n ${texShape[1]}));\n int index = 4 * (resTexRC.x * ${texShape[1]} + resTexRC.y);\n ivec4 result =\n vec4(0);\n for (int i=0; i<4; i++) {\n int flatIndex = index + i;\n ivec3 rc =\n outCoordsFromFlatIndex(flatIndex);\n result[i] = getChannel(getA(rc.x, rc.y, rc.z), vec2(rc.y, rc.z));\n }\n ${glsl.output} = result;\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
```

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```
=====\n*\n\nimport {getGslDifferences} from './gsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport class EncodeFloatProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n outTexUsage = TextureUsage.DOWNLOAD;\n\n constructor(outputShape: number[]) {\n const gsl = getGslDifferences();\n this.outputShape = outputShape;\n this.userCode = `\n ${ENCODE_FLOAT_SNIPPET}\n\n void main() {\n float x = getAAtOutCoords();\n ${gsl.output} =\n encode_float(x);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n compliance
```

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```
=====\n*\n\nimport {getGslDifferences} from './gsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport class EncodeFloatPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = true;\n packedOutput = false;\n outTexUsage = TextureUsage.DOWNLOAD;\n\n constructor(outputShape: [number, number, number]) {\n const gsl = getGslDifferences();\n this.outputShape = outputShape;\n this.userCode = `\n ${ENCODE_FLOAT_SNIPPET}\n\n void main() {\n ivec3 coords =\n getOutputCoords();\n float x = getChannel(getAAtOutCoords(),\n vec2(coords.y, coords.z));\n ${gsl.output} =\n encode_float(x);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n\n
```

```
\n=====\n\n\nimport {getGslDifferences} from './gsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from './shader_compiler_util';\n\nexport class EncodeMatrixProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(\n outputShape: [number, number, number],\n texShape: [number, number],\n inputIsUnsignedByte = false) {\n const gsl = getGslDifferences();\n const [height, width] = texShape;\n this.outputShape = outputShape;\n\n let output = `result`;\n if (inputIsUnsignedByte) {\n output = `floor(result * 255. + 0.5)`;\n }\n\n this.userCode = `\n ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 coords =\n getOutputCoords();\n\n int flatIndex = getFlatIndex(coords);\n int offset = imod(flatIndex, 4);\n\n flatIndex\n = idiv(flatIndex, 4, 1);\n\n int r = flatIndex / ${width};\n int c = imod(flatIndex, ${width});\n vec2 uv = (vec2(c, r) + halfCR) / vec2(${width}.0, ${height}.0);\n vec4 values = ${gsl.texture2D}(A, uv);\n\n float result;\n\n if (offset == 0) {\n result = values[0];\n } else if (offset == 1) {\n result = values[1];\n } else if (offset == 2) {\n result = values[2];\n } else {\n result = values[3];\n }\n\n ${gsl.output} = vec4(${output}, 0., 0., 0.);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
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```

=====
*\n\nimport {getGlsIDifferences} from './glsI_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport *
as shader_util from './shader_compiler_util';\n\n\nThis is how the shader encodes a tensor with shape = [2, 3,
5]\n(indices are [batch, row, col]).\n\n000|001 002|003 004|xxx 020|021 022|023 024|xxx\n-----
----- ----
--- ----- ----- \n010|011 012|013 014|xxx xxx|xxx xxx|xxx xxx|xxx\n\n100|101 102|103 104|xxx
120|121 122|123 124|xxx\n----- ----- ----- ----- \n110|111 112|113 114|xxx xxx|xxx
xxx|xxx xxx|xxx\n\nSingle texels contain only values from the same batch, and from
adjacent rows\nand columns.\n\n\nexport class EncodeMatrixPackedProgram implements GPGPUProgram {\n
variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = false;\n packedOutput =
true;\n\n constructor(\n outputShape: [number, number, number], texShape: [number, number],\n
inputIsUnsignedByte = false) {\n const glsl = getGlsIDifferences();\n const [height, width] = texShape;\n
this.outputShape = outputShape;\n\n let mainLoop = ";\n let output = 'result';\n if (inputIsUnsignedByte) {\n
output = 'floor(result * 255. + 0.5)';\n }\n\n for (let row = 0; row <= 1; row++) {\n for (let col = 0; col <= 1;
col++) {\n const channel = row * 2 + col;\n\n mainLoop += ` localCoords = coords;\n
if(localCoords[2] + ${col} < ${outputShape[2]}) {\n localCoords[2] += ${col};\n if(localCoords[1] +
${row} < ${outputShape[1]}) {\n localCoords[1] += ${row};\n\n flatIndex = getFlatIndex(localCoords);\n
offset = imod(flatIndex, 4);\n\n flatIndex =
idiv(flatIndex, 4, 1.);
r = flatIndex / ${width};\n c = imod(flatIndex, ${width});\n uv =
(vec2(c, r) + halfCR) / vec2(${width}.0, ${height}.0);\n values = ${glsl.texture2D}(A, uv);\n\n
if(offset == 0) {\n result[${channel}] = values[0];\n } else if(offset == 1) {\n
result[${channel}] = values[1];\n } else if(offset == 2) {\n result[${channel}] = values[2];\n
 } else {\n result[${channel}] = values[3];\n }\n }\n }\n }\n\n
this.userCode = ` ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 coords =
getOutputCoords();\n vec4 result = vec4(0.);
int flatIndex, r, c, offset;\n ivec3 localCoords;\n vec2 uv;\n vec4 values;\n\n ${mainLoop}\n\n ${glsl.output} = ${output};\n
 }\n `;\n }\n}\n\n",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under
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*\n\nimport {PixelData, TypedArray} from '@tensorflow/tfjs-core';\nimport {getGlsIDifferences} from
 './glsI_version';\nimport
 * as tex_util from './tex_util';\nimport {TextureConfig} from './tex_util';\nimport * as webgl_util from
 './webgl_util';\n\n\nexport function createVertexShader(gl: WebGLRenderingContext): WebGLShader {\n const glsl
= getGlsIDifferences();\n const vertexShaderSource = `${glsl.version}\n precision highp float;\n
${glsl.attribute} vec3 clipSpacePos;\n ${glsl.attribute} vec2 uv;\n ${glsl.varyingVs} vec2 resultUV;\n\n void
main() {\n gl_Position = vec4(clipSpacePos, 1);\n resultUV = uv;\n }`;\n return
webgl_util.createVertexShader(gl, vertexShaderSource);\n}\n\n\nexport function createVertexBuffer(gl:
WebGLRenderingContext): WebGLBuffer {\n // [x y z u v] * [upper-left, lower-left, upper-right, lower-right]\n
}

```

```

const vertexArray = new Float32Array(\n [-1, 1, 0, 0, 1, -1, -1, 0, 0, 0, 1, 1, 0, 1, 1, -1, 0, 1, 0]);\n return
webgl_util.createStaticVertexBuffer(gl, vertexArray);\n}\n\n\nexport function createIndexBuffer(gl:
WebGLRenderingContext): WebGLBuffer
{\n // OpenGL (and WebGL) have "CCW == front" winding\n const triangleVertexIndices = new
Uint16Array([0, 1, 2, 2, 1, 3]);\n return webgl_util.createStaticIndexBuffer(gl,
triangleVertexIndices);\n}\n\n\nfunction createAndConfigureTexture(\n gl: WebGLRenderingContext, width:
number, height: number,\n internalFormat: number, textureFormat: number,\n textureType: number):
WebGLTexture {\n webgl_util.validateTextureSize(width, height);\n const texture =
webgl_util.createTexture(gl);\n\n const tex2d = gl.TEXTURE_2D;\n webgl_util.callAndCheck(gl, () =>
gl.bindTexture(tex2d, texture));\n webgl_util.callAndCheck(\n gl, () => gl.texParameteri(tex2d,
gl.TEXTURE_WRAP_S, gl.CLAMP_TO_EDGE));\n webgl_util.callAndCheck(\n gl, () =>
gl.texParameteri(tex2d, gl.TEXTURE_WRAP_T, gl.CLAMP_TO_EDGE));\n webgl_util.callAndCheck(\n gl, ()
=> gl.texParameteri(tex2d, gl.TEXTURE_MIN_FILTER, gl.NEAREST));\n webgl_util.callAndCheck(\n gl, ()
=> gl.texParameteri(tex2d, gl.TEXTURE_MAG_FILTER,
gl.NEAREST));\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n tex2d, 0, internalFormat,
width, height, 0, textureFormat,\n textureType, null));\n webgl_util.callAndCheck(gl, () =>
gl.bindTexture(gl.TEXTURE_2D, null));\n return texture;\n}\n\n\nexport function
getInternalFormatForFloat32MatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.internalFormatFloat;\n}\n\n\nexport function createFloat32MatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n getInternalFormatForFloat32MatrixTexture(textureConfig),\n textureConfig.textureFormatFloat,
gl.FLOAT);\n}\n\n\nexport function getInternalFormatForFloat16MatrixTexture(\n textureConfig: TextureConfig)
{\n return textureConfig.internalFormatHalfFloat;\n}\n\n\nexport
function createFloat16MatrixTexture(\n gl: WebGLRenderingContext, rows: number, columns: number,\n
textureConfig: TextureConfig): WebGLTexture {\n const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return createAndConfigureTexture(\n
gl, width, height,\n getInternalFormatForFloat16MatrixTexture(textureConfig),\n textureConfig.textureFormatFloat, textureConfig.textureTypeHalfFloat);\n}\n\n\nexport function
getInternalFormatForUnsignedBytesMatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.downloadTextureFormat;\n}\n\n\nexport function createUnsignedBytesMatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n getInternalFormatForUnsignedBytesMatrixTexture(textureConfig),
gl.RGBA,\n gl.UNSIGNED_BYTE);\n}\n\n\nexport function getInternalFormatForPackedMatrixTexture(\n
textureConfig: TextureConfig) {\n return textureConfig.internalFormatPackedFloat;\n}\n\n\nexport function
createPackedMatrixTexture(\n gl: WebGLRenderingContext, rows: number, columns: number,\n textureConfig:
TextureConfig): WebGLTexture {\n const [width, height] =\n tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return createAndConfigureTexture(\n gl,
width, height, getInternalFormatForPackedMatrixTexture(textureConfig),\n gl.RGBA, gl.FLOAT);\n}\n\n\nexport
function getInternalFormatForFloat16PackedMatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.internalFormatPackedHalfFloat;\n}\n\n\nexport function createFloat16PackedMatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width,
height] =\n tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n

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getInternalFormatForFloat16PackedMatrixTexture(textureConfig, gl.RGBA,\n
textureConfig.textureTypeHalfFloat);\n}\n\nexport function bindVertexProgramAttributeStreams(\n gl:\n
WebGLRenderingContext, program: WebGLProgram,\n vertexBuffer: WebGLBuffer): boolean {\n const\n
posOffset = 0; // x is the first buffer element\n const uvOffset = 3 * 4; // uv comes after [x y z]\n
const stride = (3 * 4) + (2 * 4); // xyz + uv, each entry is 4-byte float.\n webgl_util.callAndCheck(\n gl, () =>\n
gl.bindBuffer(gl.ARRAY_BUFFER, vertexBuffer));\n const success =\n
webgl_util.bindVertexBufferToProgramAttribute(\n gl, program, 'clipSpacePos', vertexBuffer, 3, stride,\n
posOffset);\n return success &&\n webgl_util.bindVertexBufferToProgramAttribute(\n gl, program, 'uv',\n
vertexBuffer, 2, stride, uvOffset);\n}\n\nexport\n
function uploadDenseMatrixToTexture(\n gl: WebGLRenderingContext, texture: WebGLTexture, width:\n
number,\n height: number, data: TypedArray, textureConfig: TextureConfig) {\n webgl_util.callAndCheck(gl, ()\n
=> gl.bindTexture(gl.TEXTURE_2D, texture));\n\n let dataForUpload: TypedArray, texelDataType: number,\n
internalFormat: number;\n if (data instanceof Uint8Array) {\n dataForUpload = new Uint8Array(width * height *\n
4);\n texelDataType = gl.UNSIGNED_BYTE;\n internalFormat = gl.RGBA;\n } else {\n dataForUpload =\n
new Float32Array(width * height * 4);\n texelDataType = gl.FLOAT;\n internalFormat =\n
textureConfig.internalFormatPackedFloat;\n }\n\n dataForUpload.set(data);\n\n webgl_util.callAndCheck(\n
gl,\n () => gl.texImage2D(\n gl.TEXTURE_2D, 0, internalFormat, width, height, 0, gl.RGBA,\n
texelDataType, dataForUpload));\n\n webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,\n
null));\n}\n\nexport function\n
uploadPixelDataToTexture(\n gl: WebGLRenderingContext, texture: WebGLTexture,\n pixels:\n
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n HTMLVideoElement) {\n\n
webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n if ((pixels as PixelData).data\n
instanceof Uint8Array) {\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n
gl.TEXTURE_2D, 0, gl.RGBA, pixels.width, pixels.height, 0, gl.RGBA,\n gl.UNSIGNED_BYTE, (pixels as\n
PixelData).data));\n } else {\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n
gl.TEXTURE_2D, 0, gl.RGBA, gl.RGBA, gl.UNSIGNED_BYTE,\n pixels as ImageData | HTMLImageElement | HTMLCanvasElement |\n
HTMLVideoElement));\n }\n\n\n
webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n}\n\n\nexport function\n
createBufferFromOutputTexture(\n gl2: WebGL2RenderingContext, rows: number, columns: number,\n\n
textureConfig: TextureConfig): WebGLBuffer {\n // Create and bind the buffer.\n const buffer =\n
gl2.createBuffer();\n webgl_util.callAndCheck(\n gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER,\n
buffer));\n\n\n // Initialize the buffer to the size of the texture in bytes.\n const bytesPerFloat = 4;\n const\n
valuesPerTexel = 4;\n const bufferSizeBytes = bytesPerFloat * valuesPerTexel * rows * columns;\n\n
webgl_util.callAndCheck(\n gl2,\n () => gl2.bufferData(\n gl2.PIXEL_PACK_BUFFER,\n
bufferSizeBytes, gl2.STREAM_READ));\n\n\n // Enqueue a command on the GPU command queue to copy of\n
texture into the\n // buffer.\n webgl_util.callAndCheck(\n gl2, () => gl2.readPixels(0, 0, columns, rows,\n
gl2.RGBA, gl2.FLOAT, 0));\n\n\n webgl_util.callAndCheck(\n gl2, () =>\n
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null));\n\n return buffer;\n}\n\n\nexport function\n
downloadFloat32MatrixFromBuffer(\n gl: WebGLRenderingContext, buffer: WebGLBuffer,\n size: number):\n
Float32Array\n
{\n const gl2 = gl as WebGL2RenderingContext;\n\n const downloadTarget = new Float32Array(size);\n\n
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0,\n
downloadTarget);\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n\n return downloadTarget;\n}\n\n\nexport\n
function downloadByteEncodedFloatMatrixFromOutputTexture(\n gl: WebGLRenderingContext, rows: number,\n
columns: number,\n textureConfig: TextureConfig) {\n const [w, h] =\n
tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n\n const numChannels = 4;\n const\n
downloadTarget = new Uint8Array(\n tex_util.getUnpackedArraySizeFromMatrixSize(rows * columns,\n
numChannels));\n\n\n webgl_util.callAndCheck(\n gl,\n () => gl.readPixels(\n 0, 0, w, h,

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textureConfig.downloadTextureFormat, gl.UNSIGNED_BYTE,\n downloadTarget));\n\n // By wrapping the
buffer in a Float32Array, we use native browser IEEE 754\n // decoding of the 4 bytes
that back each 32 bit float.\n return new Float32Array(downloadTarget.buffer);\n}\n\nexport function
downloadPackedMatrixFromBuffer(\n gl: WebGLRenderingContext, buffer: WebGLBuffer, batch: number, rows:
number,\n cols: number, physicalRows: number, physicalCols: number,\n textureConfig: TextureConfig):
Float32Array {\n const gl2 = gl as WebGL2RenderingContext;\n\n const downloadTarget =\n new
Float32Array(tex_util.getPackedRGBAArraySizeFromMatrixShape(\n physicalRows, physicalCols));\n\n
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0,
downloadTarget);\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n\n return downloadTarget;\n}\n\nexport
function downloadMatrixFromPackedOutputTexture(\n gl: WebGLRenderingContext, physicalRows: number,\n
physicalCols: number): Float32Array {\n const packedRGBA = new Float32Array(physicalRows * physicalCols *
4);\n webgl_util.callAndCheck(\n gl,\n () => gl.readPixels(\n
 0, 0, physicalCols, physicalRows, gl.RGBA, gl.FLOAT, packedRGBA));\n\n return
packedRGBA;\n}\n\n", "/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {env, PixelData, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {getWebGLContext,
setWebGLContext} from './canvas_util';\nimport * as
 gpgpu_util from './gpgpu_util';\nimport * as tex_util from './tex_util';\nimport {TextureConfig} from
 './tex_util';\nimport {WebGL1DisjointQueryTimerExtension, WebGL2DisjointQueryTimerExtension} from
 './webgl_types';\nimport * as webgl_util from './webgl_util';\n\nexport interface FenceContext {\n query:
WebGLQuery|WebGLSync;\n isFencePassed(): boolean;\n}\n\nexport class GPGPUContext {\n gl:
WebGLRenderingContext;\n textureFloatExtension: {};\n textureHalfFloatExtension: {};\n
 colorBufferFloatExtension: {};\n colorBufferHalfFloatExtension: {};\n disjointQueryTimerExtension:
WebGL2DisjointQueryTimerExtension|\n WebGL1DisjointQueryTimerExtension;\n vertexBuffer:
WebGLBuffer;\n indexBuffer: WebGLBuffer;\n framebuffer: WebGLFramebuffer;\n outputTexture:
WebGLTexture|null = null;\n program: WebGLProgram|null = null;\n private disposed = false;\n private disjoint:
boolean;\n textureConfig: TextureConfig;\n\n constructor(gl?: WebGLRenderingContext) {\n const glVersion
= env().getNumber('WEBGL_VERSION');\n if (gl != null) {\n this.gl = gl;\n setWebGLContext(glVersion,
gl);\n } else {\n this.gl = getWebGLContext(glVersion);\n }\n // WebGL 2.0 enables texture floats without
an extension.\n let COLOR_BUFFER_FLOAT = 'WEBGL_color_buffer_float';\n const
COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n if
(env().getNumber('WEBGL_VERSION') === 1) {\n const TEXTURE_FLOAT = 'OES_texture_float';\n const
TEXTURE_HALF_FLOAT = 'OES_texture_half_float';\n this.textureFloatExtension =\n webgl_util.getExtensionOrThrow(this.gl, TEXTURE_FLOAT);\n if (webgl_util.hasExtension(this.gl,
TEXTURE_HALF_FLOAT)) {\n this.textureHalfFloatExtension =\n webgl_util.getExtensionOrThrow(this.gl, TEXTURE_HALF_FLOAT);\n } else if
(env().get('WEBGL_FORCE_F16_TEXTURES')) {\n throw new Error(\n 'GL context does not support
half float textures, yet the ' +\n 'environment
flag WEBGL_FORCE_F16_TEXTURES is set to true.);\n }\n this.colorBufferFloatExtension =
this.gl.getExtension(COLOR_BUFFER_FLOAT);\n if (webgl_util.hasExtension(this.gl,
COLOR_BUFFER_HALF_FLOAT)) {\n this.colorBufferHalfFloatExtension =\n webgl_util.getExtensionOrThrow(this.gl, COLOR_BUFFER_HALF_FLOAT);\n } else if

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(env().get('WEBGL_FORCE_F16_TEXTURES')) {\n throw new Error(\n 'GL context does not support
color renderable half floats, yet ' +\n 'the environment flag WEBGL_FORCE_F16_TEXTURES is set to
true.);\n }\n } else {\n COLOR_BUFFER_FLOAT = 'EXT_color_buffer_float';\n if
(webgl_util.hasExtension(this.gl, COLOR_BUFFER_FLOAT)) {\n this.colorBufferFloatExtension =\nthis.gl.getExtension(COLOR_BUFFER_FLOAT);\n } else if (webgl_util.hasExtension(this.gl,
COLOR_BUFFER_HALF_FLOAT)) {\n this.colorBufferHalfFloatExtension =\nthis.gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n
 } else {\n throw new Error('GL context does not support color renderable floats');\n }\n }\n\n
this.vertexBuffer = gpgpu_util.createVertexBuffer(this.gl);\n this.indexBuffer =
gpgpu_util.createIndexBuffer(this.gl);\n this.framebuffer = webgl_util.createFramebuffer(this.gl);\n\n
this.textureConfig =\n tex_util.getTextureConfig(this.gl, this.textureHalfFloatExtension);\n }\n\n private get
debug(): boolean {\n return env().getBool('DEBUG');\n }\n\n public dispose() {\n if (this.disposed) {\n
return;\n }\n if (this.program != null) {\n console.warn(\n 'Disposing a GPGPUContext that still has a
bound WebGLProgram.' +\n ' This is probably a resource leak, delete the program with ' +\n
'GPGPUContext.deleteProgram before disposing.);\n }\n if (this.outputTexture != null) {\n console.warn(\n
'Disposing a GPGPUContext that still has a bound output matrix ' +\n
'texture. This is probably a resource leak, delete the output ' +\n 'matrix texture with
GPGPUContext.deleteMatrixTexture before ' +\n 'disposing.);\n }\n const gl = this.gl;\n
webgl_util.callAndCheck(gl, () => gl.finish());\n webgl_util.callAndCheck(gl, () =>
gl.bindFramebuffer(gl.FRAMEBUFFER, null));\n webgl_util.callAndCheck(gl, () =>
gl.deleteFramebuffer(this.framebuffer));\n webgl_util.callAndCheck(gl, () =>
gl.bindBuffer(gl.ARRAY_BUFFER, null));\n webgl_util.callAndCheck(\n gl, () =>
gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER, null));\n webgl_util.callAndCheck(gl, () =>
gl.deleteBuffer(this.indexBuffer));\n this.disposed = true;\n }\n\n public createFloat32MatrixTexture(rows:
number, columns: number):\n WebGLTexture {\n this.throwIfDisposed();\n return
gpgpu_util.createFloat32MatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public
createFloat16MatrixTexture(rows: number, columns: number):\n
 WebGLTexture {\n this.throwIfDisposed();\n return gpgpu_util.createFloat16MatrixTexture(\n this.gl,
rows, columns, this.textureConfig);\n }\n\n public createUnsignedBytesMatrixTexture(rows: number, columns:
number):\n WebGLTexture {\n this.throwIfDisposed();\n return
gpgpu_util.createUnsignedBytesMatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public
uploadPixelDataToTexture(\n texture: WebGLTexture,\n pixels:
ImageData|ImageData|HTMLImageElement|HTMLCanvasElement) {\n this.throwIfDisposed();\n
gpgpu_util.uploadPixelDataToTexture(this.gl, texture, pixels);\n }\n\n public uploadDenseMatrixToTexture(\n
texture: WebGLTexture, width: number, height: number, data: TypedArray) {\n this.throwIfDisposed();\n
gpgpu_util.uploadDenseMatrixToTexture(\n this.gl, texture, width, height, data, this.textureConfig);\n }\n\n
public createFloat16PackedMatrixTexture(rows: number, columns: number):\n
 WebGLTexture {\n this.throwIfDisposed();\n return gpgpu_util.createFloat16PackedMatrixTexture(\n
this.gl, rows, columns, this.textureConfig);\n }\n\n public createPackedMatrixTexture(rows: number, columns:
number):\n WebGLTexture {\n this.throwIfDisposed();\n return gpgpu_util.createPackedMatrixTexture(\n
this.gl, rows, columns, this.textureConfig);\n }\n\n public deleteMatrixTexture(texture: WebGLTexture) {\n
this.throwIfDisposed();\n if (this.outputTexture === texture) {\n
webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n this.outputTexture = null;\n }\n
webgl_util.callAndCheck(this.gl, () => this.gl.deleteTexture(texture));\n }\n\n public
downloadByteEncodedFloatMatrixFromOutputTexture(\n texture: WebGLTexture, rows: number, columns:
number): Float32Array {\n return this.downloadMatrixDriver(\n texture,\n () =>
gpgpu_util.downloadByteEncodedFloatMatrixFromOutputTexture(\n

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 this.gl, rows, columns, this.textureConfig));\n } \n\n public downloadPackedMatrixFromBuffer(\n buffer:
WebGLBuffer, batch: number, rows: number, columns: number,\n physicalRows: number, physicalCols:
number): Float32Array {\n return gpgpu_util.downloadPackedMatrixFromBuffer(\n this.gl, buffer, batch,
rows, columns, physicalRows, physicalCols,\n this.textureConfig);\n } \n\n public
downloadFloat32MatrixFromBuffer(buffer: WebGLBuffer, size: number):\n Float32Array {\n return
gpgpu_util.downloadFloat32MatrixFromBuffer(this.gl, buffer, size);\n } \n\n public createBufferFromTexture(\n
texture: WebGLTexture, rows: number, columns: number): WebGLBuffer {\n
this.bindTextureToFramebuffer(texture);\n const result = gpgpu_util.createBufferFromOutputTexture(\n
this.gl as WebGL2RenderingContext, rows, columns, this.textureConfig);\n
this.unbindTextureToFramebuffer();\n return result;\n } \n\n public createAndWaitForFence():
Promise<void> {\n const fenceContext = this.createFence(this.gl);\n return this.pollFence(fenceContext);\n
} \n\n private createFence(gl: WebGLRenderingContext): FenceContext {\n let query:
WebGLQuery|WebGLSync;\n let isFencePassed: () => boolean;\n\n if
(env().getBool('WEBGL_FENCE_API_ENABLED')) {\n const gl2 = gl as WebGL2RenderingContext;\n\n const sync = gl2.fenceSync(gl2.SYNC_GPU_COMMANDS_COMPLETE, 0);\n gl.flush();\n\n isFencePassed = () => {\n const status = gl2.clientWaitSync(sync, 0, 0);\n return status ===
gl2.ALREADY_SIGNALED ||\n status === gl2.CONDITION_SATISFIED;\n };\n\n query = sync;\n } else if (\n env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0) {\n
query = this.beginQuery();\n this.endQuery();\n isFencePassed = () => this.isQueryAvailable(\n query,\n env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));\n } else {\n
// If we have no way to fence, return true immediately. This will fire in\n // WebGL 1.0 when there is no
disjoint query timer. In this case, because\n // the fence passes immediately, we'll immediately ask for a
download of\n // the texture, which will cause the UI thread to hang.\n isFencePassed = () => true;\n } \n\n
return {query, isFencePassed};\n } \n\n public downloadMatrixFromPackedTexture(\n texture: WebGLTexture,
physicalRows: number,\n physicalCols: number): Float32Array {\n return this.downloadMatrixDriver(\n
texture,\n () => gpgpu_util.downloadMatrixFromPackedOutputTexture(\n this.gl, physicalRows,
physicalCols));\n } \n\n private vertexAttrsAreBound = false;\n\n public createProgram(fragmentShaderSource:
string): WebGLProgram {\n this.throwIfDisposed();\n const gl = this.gl;\n const fragmentShader:
WebGLShader =\n webgl_util.createFragmentShader(gl, fragmentShaderSource);\n const vertexShader:
WebGLShader = gpgpu_util.createVertexShader(gl);\n const program: WebGLProgram =
webgl_util.createProgram(gl);\n webgl_util.callAndCheck(gl, () => gl.attachShader(program, vertexShader));\n
webgl_util.callAndCheck(gl, () => gl.attachShader(program, fragmentShader));\n webgl_util.linkProgram(gl,
program);\n if (this.debug) {\n webgl_util.validateProgram(gl, program);\n } \n if
(!this.vertexAttrsAreBound) {\n this.setProgram(program);\n this.vertexAttrsAreBound =
gpgpu_util.bindVertexProgramAttributeStreams(\n gl, this.program, this.vertexBuffer);\n } \n return
program;\n } \n\n public deleteProgram(program: WebGLProgram) {\n this.throwIfDisposed();\n if (program
=== this.program) {\n this.program = null;\n } \n if (program != null) {\n webgl_util.callAndCheck(this.gl,
() => this.gl.deleteProgram(program));\n } \n } \n\n public setProgram(program: WebGLProgram|null) {\n
this.throwIfDisposed();\n this.program
= program;\n if ((this.program != null) && this.debug) {\n webgl_util.validateProgram(this.gl,
this.program);\n } \n webgl_util.callAndCheck(this.gl, () => this.gl.useProgram(program));\n } \n\n public
getUniformLocation(\n program: WebGLProgram, uniformName: string,\n shouldThrow = true):
WebGLUniformLocation {\n this.throwIfDisposed();\n if (shouldThrow) {\n return
webgl_util.getProgramUniformLocationOrThrow(\n this.gl, program, uniformName);\n } else {\n return
webgl_util.getProgramUniformLocation(\n this.gl, program, uniformName);\n } \n } \n\n public
getAttributeLocation(program: WebGLProgram, attribute: string):\n number {\n this.throwIfDisposed();\n
return webgl_util.callAndCheck(\n this.gl, () => this.gl.getAttribLocation(program, attribute));\n } \n\n public
getUniformLocationNoThrow(program: WebGLProgram, uniformName: string):\n WebGLUniformLocation {\n

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 this.throwIfDisposed();\n
 return this.gl.getUniformLocation(program, uniformName);\n } \n\n public setInputMatrixTexture(\n
inputMatrixTexture: WebGLTexture, uniformLocation: WebGLUniformLocation,\n textureUnit: number) {\n
this.throwIfDisposed();\n this.throwIfNoProgram();\n webgl_util.bindTextureToProgramUniformSampler(\n
this.gl, inputMatrixTexture, uniformLocation, textureUnit);\n } \n\n public setOutputMatrixTexture(\n
outputMatrixTexture: WebGLTexture, rows: number, columns: number) {\n
this.setOutputMatrixTextureDriver(outputMatrixTexture, columns, rows);\n } \n\n public
setOutputPackedMatrixTexture(\n outputPackedMatrixTexture: WebGLTexture, rows: number, columns:
number) {\n this.throwIfDisposed();\n const [width, height] =\n
tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n
this.setOutputMatrixTextureDriver(outputPackedMatrixTexture, width, height);\n } \n\n public
setOutputMatrixWriteRegion(\n startRow: number, numRows:
number, startColumn: number,\n numColumns: number) {\n this.setOutputMatrixWriteRegionDriver(\n
startColumn, startRow, numColumns, numRows);\n } \n\n public setOutputPackedMatrixWriteRegion(\n
startRow: number, numRows: number, startColumn: number,\n numColumns: number) {\n throw new
Error('setOutputPackedMatrixWriteRegion not implemented.);\n } \n\n public debugValidate() {\n if
(this.program != null) {\n webgl_util.validateProgram(this.gl, this.program);\n } \n\n
webgl_util.validateFramebuffer(this.gl);\n } \n\n public executeProgram() {\n this.throwIfDisposed();\n
this.throwIfNoProgram();\n const gl = this.gl;\n if (this.debug) {\n this.debugValidate();\n } \n\n
webgl_util.callAndCheck(\n gl, () => gl.drawElements(gl.TRIANGLES, 6, gl.UNSIGNED_SHORT, 0));\n
}\n\n public blockUntilAllProgramsCompleted() {\n this.throwIfDisposed();\n webgl_util.callAndCheck(this.gl,
() => this.gl.finish());\n } \n\n private
getQueryTimerExtension(): WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension
{\n if (this.disjointQueryTimerExtension == null) {\n this.disjointQueryTimerExtension =\n
webgl_util.getExtensionOrThrow(\n this.gl,\n env().getNumber(\n
'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2 ?\n
'EXT_disjoint_timer_query_webgl2' :\n 'EXT_disjoint_timer_query') as\n
WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension;\n } \n\n return
this.disjointQueryTimerExtension;\n } \n\n private getQueryTimerExtensionWebGL2():
WebGL2DisjointQueryTimerExtension {\n return this.getQueryTimerExtension();\n } \n\n private
getQueryTimerExtensionWebGL1(): WebGL1DisjointQueryTimerExtension {\n return
this.getQueryTimerExtension() as WebGL1DisjointQueryTimerExtension;\n } \n\n beginQuery(): WebGLQuery
{\n if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')
=== 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n const ext =
this.getQueryTimerExtensionWebGL2();\n\n const query = gl2.createQuery();\n
gl2.beginQuery(ext.TIME_ELAPSED_EXT, query);\n return query;\n } \n\n const ext =
this.getQueryTimerExtensionWebGL1();\n const query = ext.createQueryEXT() as WebGLQuery;\n
ext.beginQueryEXT(ext.TIME_ELAPSED_EXT, query);\n return query;\n } \n\n endQuery() {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2) {\n const gl2 =
this.gl as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n
gl2.endQuery(ext.TIME_ELAPSED_EXT);\n return;\n } \n\n const ext =
this.getQueryTimerExtensionWebGL1();\n ext.endQueryEXT(ext.TIME_ELAPSED_EXT);\n } \n\n public async
waitForQueryAndGetTime(query: WebGLQuery): Promise<number> {\n await util.repeatedTry(\n () =>
this.disposed || // while testing
contexts are created / disposed\n // in rapid succession, so without this check we\n
// may poll for the query timer indefinitely\n this.isQueryAvailable(\n query,\n
env().getNumber(\n 'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')));\n return
this.getQueryTime(\n query,

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env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION');\n } private
getQueryTime(query: WebGLQuery, queryTimerVersion: number): number {\n if (queryTimerVersion === 0) {\n
return null;\n }\n if (queryTimerVersion === 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n
const timeElapsedNanos = gl2.getQueryParameter(query, gl2.QUERY_RESULT);\n // Return milliseconds.\n
return timeElapsedNanos / 1000000;\n } else {\n const ext = this.getQueryTimerExtensionWebGL1();\n
const timeElapsedNanos =\n ext.getQueryObjectEXT(query,\n
ext.QUERY_RESULT_EXT);\n // Return milliseconds.\n return timeElapsedNanos / 1000000;\n }\n }\n
private isQueryAvailable(query: WebGLQuery, queryTimerVersion: number):\n boolean {\n if
(queryTimerVersion === 0) {\n return true;\n }\n if (queryTimerVersion === 2) {\n const gl2 = this.gl
as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n const available =\n
gl2.getQueryParameter(query, gl2.QUERY_RESULT_AVAILABLE);\n if (this.disjoint == null) {\n
this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n return available && !this.disjoint;\n
} else {\n const ext = this.getQueryTimerExtensionWebGL1();\n const available =\n
ext.getQueryObjectEXT(query, ext.QUERY_RESULT_AVAILABLE_EXT);\n if (this.disjoint == null) {\n
this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n return available && !this.disjoint;\n
}\n }\n pollFence(fenceContext: FenceContext) {\n return new Promise<void>(resolve => {\n
this.addItemToPoll(() => fenceContext.isFencePassed(), () => resolve());\n });\n }\n private itemsToPoll:
PollItem[] = [];\n pollItems(): void {\n // Find the last query that has finished.\n const index =
linearSearchLastTrue(this.itemsToPoll.map(x => x.isDoneFn));\n for (let i = 0; i <= index; ++i) {\n const
{resolveFn} = this.itemsToPoll[i];\n resolveFn();\n }\n this.itemsToPoll = this.itemsToPoll.slice(index +
1);\n }\n private addItemToPoll(isDoneFn: () => boolean, resolveFn: () => void) {\n
this.itemsToPoll.push({isDoneFn, resolveFn});\n if (this.itemsToPoll.length > 1) {\n // We already have a
running loop that polls.\n return;\n }\n // Start a new loop that polls.\n util.repeatedTry(() => {\n
this.pollItems();\n // End the loop if no more items to poll.\n return this.itemsToPoll.length ===
0;\n });\n }\n private bindTextureToFramebuffer(texture: WebGLTexture) {\n this.throwIfDisposed();\n
webgl_util.bindColorTextureToFramebuffer(\n this.gl, texture, this.framebuffer);\n if (this.debug) {\n
webgl_util.validateFramebuffer(this.gl);\n }\n }\n private unbindTextureToFramebuffer() {\n if
(this.outputTexture != null) {\n webgl_util.bindColorTextureToFramebuffer(\n this.gl, this.outputTexture,\n
this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(this.gl);\n }\n } else {\n
webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n }\n }\n private
downloadMatrixDriver(\n texture: WebGLTexture,\n downloadAndDecode: () => Float32Array):
Float32Array {\n this.bindTextureToFramebuffer(texture);\n const result = downloadAndDecode();\n
this.unbindTextureToFramebuffer();\n return result;\n }\n private setOutputMatrixTextureDriver(\n
outputMatrixTextureMaybePacked:
WebGLTexture, width: number,\n height: number) {\n this.throwIfDisposed();\n const gl = this.gl;\n
webgl_util.bindColorTextureToFramebuffer(\n gl, outputMatrixTextureMaybePacked, this.framebuffer);\n if
(this.debug) {\n webgl_util.validateFramebuffer(gl);\n }\n this.outputTexture =
outputMatrixTextureMaybePacked;\n webgl_util.callAndCheck(gl, () => gl.viewport(0, 0, width, height));\n
webgl_util.callAndCheck(gl, () => gl.scissor(0, 0, width, height));\n }\n private
setOutputMatrixWriteRegionDriver(\n x: number, y: number, width: number, height: number) {\n
this.throwIfDisposed();\n webgl_util.callAndCheck(\n this.gl, () => this.gl.scissor(x, y, width, height));\n
}\n private throwIfDisposed() {\n if (this.disposed) {\n throw new Error('Attempted to use disposed
GPGPUContext.);\n }\n }\n private throwIfNoProgram() {\n if (this.program == null) {\n throw new
Error('No
GPU program is currently set.);\n }\n }\n }\n\n type PollItem = {\n isDoneFn: () => boolean,\n
resolveFn: () => void\n};\n\n /**\n * Finds the index of the last true element using linear search.\n * Note: We can't do binary search
because Chrome expects us to explicitly\n * test all fences before download.\n */\n
https://github.com/tensorflow/tfjs/issues/1145\n\n ^\n\n export function linearSearchLastTrue(arr: Array<() =>

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boolean>): number {\n let i = 0;\n for (; i < arr.length; ++i) {\n const isDone = arr[i]();\n if (!isDone) {\n break;\n }\n }\n return i - 1;\n}\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License\n * is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */
```

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=====\n
*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\nconst {getBroadcastDims} = backend_util;\nimport {getGlsIDifferences, GLSL} from './glsl_version';\nimport * as shader_util from './shader_compiler_util';\n\nexport\n type ShapeInfo = {\n logicalShape: number[],\n texShape: [number, number],\n isUniform: boolean,\n isPacked:\n boolean,\n flatOffset: number\n};\n\nexport type InputInfo = {\n name: string,\n shapeInfo:\n ShapeInfo\n};\n\nexport function makeShader(\n inputsInfo: InputInfo[], outputShape: ShapeInfo, userCode:\n string,\n usesPackedTextures: boolean): string {\n const prefixSnippets: string[] = [];\n inputsInfo.forEach(x =>\n {\n const size = util.sizeFromShape(x.shapeInfo.logicalShape);\n\n // Snippet when we decided to upload the values as uniform.\n if (x.shapeInfo.isUniform) {\n prefixSnippets.push(\n `uniform float ${x.name}${size > 1 ? `[${size}]` : ``};`);\n } else {\n prefixSnippets.push(`uniform sampler2D ${x.name};`);\n prefixSnippets.push(`uniform int offset${x.name};`);\n }\n });\n const inputPrefixSnippet = prefixSnippets.join("\\n");\n const inputSamplingSnippet =\n inputsInfo\n .map(x => getInputSamplingSnippet(x, outputShape, usesPackedTextures))\n .join("\\n");\n const outTexShape = outputShape.texShape;\n const glsl = getGlsIDifferences();\n const\n floatTextureSampleSnippet = getFloatTextureSampleSnippet(glsl);\n let outputSamplingSnippet: string;\n let\n floatTextureSetOutputSnippet: string;\n let shaderPrefix = getShaderPrefix(glsl);\n if (outputShape.isPacked) {\n outputSamplingSnippet =\n getPackedOutputSamplingSnippet(outputShape.logicalShape,\n outTexShape);\n floatTextureSetOutputSnippet = getFloatTextureSetRGBASnippet(glsl);\n } else {\n outputSamplingSnippet =\n getOutputSamplingSnippet(outputShape.logicalShape, outTexShape);\n floatTextureSetOutputSnippet = getFloatTextureSetRSnippet(glsl);\n }\n if (usesPackedTextures) {\n shaderPrefix += SHADER_PACKED_PREFIX;\n }\n const source = [\n shaderPrefix,\n floatTextureSampleSnippet, floatTextureSetOutputSnippet,\n inputPrefixSnippet, outputSamplingSnippet,\n inputSamplingSnippet, userCode\n].join("\\n");\n return source;\n}\n\nfunction getSamplerFromInInfo(inInfo:\n InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch (shape.length) {\n case 0:\n return\n getSamplerScalar(inInfo);\n case 1:\n return getSampler1D(inInfo);\n case 2:\n return\n getSampler2D(inInfo);\n case 3:\n return getSampler3D(inInfo);\n case 4:\n return\n getSampler4D(inInfo);\n case 5:\n return\n getSampler5D(inInfo);\n case 6:\n return getSampler6D(inInfo);\n default:\n throw new Error(`\n ${shape.length}-D input sampling` +\n ` is not yet supported`);\n }\n}\n\nfunction\n getPackedSamplerFromInInfo(inInfo: InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch\n (shape.length) {\n case 0:\n return getPackedSamplerScalar(inInfo);\n case 1:\n return\n getPackedSampler1D(inInfo);\n case 2:\n return\n getPackedSampler2D(inInfo);\n case 3:\n return\n getPackedSampler3D(inInfo);\n default:\n return\n getPackedSamplerND(inInfo);\n }\n}\n\nfunction\n getInputSamplingSnippet(\n inInfo: InputInfo, outShapeInfo: ShapeInfo,\n usesPackedTextures = false): string\n {\n let res = `);\n if (usesPackedTextures) {\n res +=\n getPackedSamplerFromInInfo(inInfo);\n } else {\n res +=\n getSamplerFromInInfo(inInfo);\n }\n const inShape = inInfo.shapeInfo.logicalShape;\n const outShape =\n outShapeInfo.logicalShape;\n\n if (inShape.length <= outShape.length) {\n if (usesPackedTextures) {\n res +=\n getPackedSamplerAtOutputCoords(inInfo, outShapeInfo);\n } else {\n res +=
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getSamplerAtOutputCoords(inInfo, outShapeInfo);\n } \n } \n return res;\n}\n\nfunction
getPackedOutputSamplingSnippet(\n outShape: number[], outTexShape: [number, number]): string {\n switch
(outShape.length) {\n case 0:\n return getOutputScalarCoords();\n case 1:\n return
getOutputPacked1DCoords(outShape as [number], outTexShape);\n case 2:\n return
getOutputPacked2DCoords(outShape as [number, number], outTexShape);\n case 3:\n return
getOutputPacked3DCoords(\n outShape as [number, number, number], outTexShape);\n default:\n return
getOutputPackedNDCoords(outShape, outTexShape);\n } \n}\n\nfunction getOutputSamplingSnippet(\n
outShape: number[], outTexShape: [number, number]): string {\n switch (outShape.length) {\n case 0:\n return
getOutputScalarCoords();\n case 1:\n return getOutput1DCoords(outShape as [number], outTexShape);\n
case 2:\n return getOutput2DCoords(outShape as [number, number], outTexShape);\n case 3:\n return
getOutput3DCoords(\n outShape as [number, number, number], outTexShape);\n case 4:\n return
getOutput4DCoords(\n outShape as [number, number, number, number], outTexShape);\n case 5:\n return
getOutput5DCoords(\n outShape as [number, number, number, number, number], outTexShape);\n case 6:\n
return getOutput6DCoords(\n outShape as [number, number, number, number, number, number],\n
outTexShape);\n default:\n throw new Error(\n ` ${outShape.length}-D output sampling is not yet
supported`);\n } \n}\n\nfunction getFloatTextureSampleSnippet(glsl: GLSL): string {\n return `\n float
sampleTexture(sampler2D textureSampler, vec2 uv) {\n return ${glsl.texture2D}(textureSampler, uv).r;\n
}\n `;\n}\n\nfunction getFloatTextureSetRSnippet(glsl: GLSL): string {\n return `\n void setOutput(float val)
{\n ${glsl.output} = vec4(val, 0, 0, 0);\n }\n `;\n}\n\nfunction getFloatTextureSetRGBASnippet(glsl: GLSL):
string {\n return `\n void setOutput(vec4 val) {\n ${glsl.output} = val;\n }\n `;\n}\n\nfunction
getShaderPrefix(glsl: GLSL): string {\n const SHADER_PREFIX = `${glsl.version}\n precision highp float;\n
precision highp int;\n precision highp sampler2D;\n ${glsl.varyingFs} vec2 resultUV;\n
${glsl.defineOutput}\n const vec2 halfCR = vec2(0.5, 0.5);\n\n struct ivec5\n {\n int x;\n int y;\n int
z;\n int w;\n int u;\n };\n\n struct ivec6\n {\n int x;\n int y;\n int z;\n int w;\n int u;\n
int v;\n };\n\n uniform float NAN;\n ${glsl.defineSpecialNaN}\n ${glsl.defineSpecialInf}\n
${glsl.defineRound}\n\n int imod(int x, int y) {\n return
x - y * (x / y);\n }\n\n int idiv(int a, int b, float sign) {\n int res = a / b;\n int mod = imod(a, b);\n if
(sign < 0. && mod != 0) {\n res -= 1;\n }\n return res;\n }\n\n //Based on the work of Dave Hoskins\n
//https://www.shadertoy.com/view/4djSRW\n #define HASHSCALE1 443.8975\n float random(float seed){\n
vec2 p = resultUV * seed;\n vec3 p3 = fract(vec3(p.xyx) * HASHSCALE1);\n p3 += dot(p3, p3.yzx +
19.19);\n return fract((p3.x + p3.y) * p3.z);\n }\n\n ${SAMPLE_1D_SNIPPET}\n
${SAMPLE_2D_SNIPPET}\n ${SAMPLE_3D_SNIPPET}\n `;\n\n return SHADER_PREFIX;\n}\n\nconst
SAMPLE_1D_SNIPPET = `\nvec2 uvFromFlat(int texNumR, int texNumC, int index) {\n int texR = index /
texNumC;\n int texC = index - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n\nvec2 packedUVfrom1D(int texNumR, int texNumC, int index) {\n int texelIndex = index / 2;\n
int texR = texelIndex / texNumC;\n\n int texC = texelIndex - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n\nconst SAMPLE_2D_SNIPPET = `\nvec2 packedUVfrom2D(int texelsInLogicalRow, int
texNumR,\n int texNumC, int row, int col) {\n int texelIndex = (row / 2) * texelsInLogicalRow + (col / 2);\n
int texR = texelIndex / texNumC;\n int texC = texelIndex - texR * texNumC;\n return (vec2(texC, texR) + halfCR) /
vec2(texNumC, texNumR);\n}\n\nconst SAMPLE_3D_SNIPPET = `\nvec2 packedUVfrom3D(int texNumR, int
texNumC,\n int texelsInBatch, int texelsInLogicalRow, int b,\n int row, int col) {\n int index = b * texelsInBatch
+ (row / 2) * texelsInLogicalRow + (col / 2);\n int texR = index / texNumC;\n int texC = index - texR *
texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC, texNumR);\n}\n\nconst
SHADER_PACKED_PREFIX = `\n float getChannel(vec4 frag, vec2 innerDims) {\n vec2 modCoord =
mod(innerDims, 2.);\n return modCoord.x == 0. ?\n (modCoord.y
== 0. ? frag.r : frag.g) :\n (modCoord.y == 0. ? frag.b : frag.a);\n }\n float getChannel(vec4 frag, int dim) {\n
float modCoord = mod(float(dim), 2.);\n return modCoord == 0. ? frag.r : frag.g;\n }\n `;\n\nfunction

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getOutputScalarCoords() {\n return \n int getOutputCoords() {\n return 0;\n }\n `;\n}\n\nfunction
getOutputPacked1DCoords(\n shape: [number], texShape: [number, number]): string {\n const packedTexShape
=\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n if (packedTexShape[0] === 1) {\n return \n
int getOutputCoords() {\n return 2 * int(resultUV.x * ${packedTexShape[1]}.0);\n }\n `;\n }\n\n if
(packedTexShape[1] === 1) {\n return \n int getOutputCoords() {\n return 2 * int(resultUV.y *
${packedTexShape[0]}.0);\n }\n `;\n }\n\n return \n int getOutputCoords() {\n ivec2 resTexRC =
ivec2(resultUV.yx *\n vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n
return 2 * (resTexRC.x * ${packedTexShape[1]} + resTexRC.y);\n }\n `;\n}\n\nfunction
getOutput1DCoords(\n shape: [number], texShape: [number, number]): string {\n if (texShape[0] === 1) {\n
return \n int getOutputCoords() {\n return int(resultUV.x * ${texShape[1]}.0);\n }\n `;\n }\n\n if
(texShape[1] === 1) {\n return \n int getOutputCoords() {\n return int(resultUV.y * ${texShape[0]}.0);\n
}\n `;\n }\n\n return \n int getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n
vec2(${texShape[0]}, ${texShape[1]}));\n return resTexRC.x * ${texShape[1]} + resTexRC.y;\n }\n
`;\n}\n\nfunction getOutputPacked3DCoords(\n shape: [number, number, number], texShape: [number, number]):
string {\n const packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const
texelsInLogicalRow = Math.ceil(shape[2] / 2);\n const texelsInBatch = texelsInLogicalRow
* Math.ceil(shape[1] / 2);\n\n return \n ivec3 getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n
vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n int index = resTexRC.x *
${packedTexShape[1]} + resTexRC.y;\n int b = index / ${texelsInBatch};\n index -= b *
${texelsInBatch};\n int r = 2 * (index / ${texelsInLogicalRow});\n int c = imod(index,
${texelsInLogicalRow}) * 2;\n\n return ivec3(b, r, c);\n }\n `;\n}\n\nfunction getOutput3DCoords(\n shape:
[number, number, number], texShape: [number, number]): string {\n const coordsFromIndexSnippet =\n
shader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);\n\n return \n ivec3 getOutputCoords() {\n
ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n int index
= resTexRC.x * ${texShape[1]} + resTexRC.y;\n ${coordsFromIndexSnippet}\n return
ivec3(r, c, d);\n }\n `;\n}\n\nfunction getOutputPackedNDCoords(\n shape: number[], texShape: [number,
number]): string {\n const packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n\n
const texelsInLogicalRow = Math.ceil(shape[shape.length - 1] / 2);\n const texelsInBatch =\n
texelsInLogicalRow * Math.ceil(shape[shape.length - 2] / 2);\n let texelsInBatchN = texelsInBatch;\n let batches =
``;\n let coords = 'b, r, c';\n\n for (let b = 2; b < shape.length - 1; b++) {\n texelsInBatchN *= shape[shape.length -
b - 1];\n batches = \n int b${b} = index / ${texelsInBatchN};\n index -= b${b} * ${texelsInBatchN};\n `
+ batches;\n coords = `b${b}, ` + coords;\n }\n\n return \n ivec${shape.length} getOutputCoords() {\n
ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${packedTexShape[0]},
${packedTexShape[1]}));\n int index = resTexRC.x * ${packedTexShape[1]} + resTexRC.y;\n\n
${batches}\n int b = index / ${texelsInBatch};\n index -= b * ${texelsInBatch};\n int r = 2 * (index /
${texelsInLogicalRow});\n int c = imod(index, ${texelsInLogicalRow}) * 2;\n\n return
ivec${shape.length}(${coords});\n }\n `;\n}\n\nfunction getOutput4DCoords(\n shape: [number, number,
number, number],\n texShape: [number, number]): string {\n const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n ['r', 'c', 'd', 'd2'], shape);\n\n return \n ivec4
getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *\n vec2(${texShape[0]}, ${texShape[1]}));\n
int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n ${coordsFromIndexSnippet}\n return ivec4(r, c,
d, d2);\n }\n `;\n}\n\nfunction getOutput5DCoords(\n shape: [number, number, number, number, number],\n
texShape: [number, number]): string {\n const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n
['r', 'c', 'd', 'd2', 'd3'], shape);\n\n return \n ivec5 getOutputCoords() {\n ivec2 resTexRC =
ivec2(resultUV.yx * vec2(${texShape[0]},\n ${texShape[1]}));\n int index = resTexRC.x *
${texShape[1]} + resTexRC.y;\n\n ${coordsFromIndexSnippet}\n\n ivec5 outShape = ivec5(r, c, d, d2, d3);\n
return outShape;\n }\n `;\n}\n\nfunction getOutput6DCoords(\n shape: [number, number, number, number,
number, number],

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number, number],\n texShape: [number, number]): string {\n const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n [r, 'c', 'd', 'd2', 'd3', 'd4'], shape);\n\n return \n ivec6
getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx * \n vec2(${texShape[0]}, ${texShape[1]}));\n
 int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n\n ${coordsFromIndexSnippet}\n\n ivec6 result =
ivec6(r, c, d, d2, d3, d4);\n return result;\n }\n `;\n\n\nfunction getOutputPacked2DCoords(\n
 shape: [number, number], texShape: [number, number]): string {\n const packedTexShape = \n
[Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n if (util.arraysEqual(shape, texShape)) {\n return \n
ivec2 getOutputCoords() {\n return 2 * ivec2(resultUV.yx * vec2(${packedTexShape[0]}, ${\n
packedTexShape[1]}));\n }\n `;\n }\n\n // texels needed to accommodate a logical row\n const
texelsInLogicalRow = Math.ceil(shape[1] / 2);\n\n /**\n * getOutputCoords\n * \n * resTexRC: The rows and
columns of the texels. If you move over one\n * texel to the right in the packed texture, you are moving over one
column\n * (not two).\n * \n * index: The texel index\n * \n * \n */\n return \n ivec2 getOutputCoords() {\n ivec2
resTexRC = ivec2(resultUV.yx * \n vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n\n
 int index = resTexRC.x * ${packedTexShape[1]} + resTexRC.y;\n int r = 2 * (index
/ ${texelsInLogicalRow});\n int c = imod(index, ${texelsInLogicalRow}) * 2;\n\n return ivec2(r, c);\n }\n
`;\n\n\nfunction getOutput2DCoords(\n shape: [number, number], texShape: [number, number]): string {\n if
(util.arraysEqual(shape, texShape)) {\n return \n ivec2 getOutputCoords() {\n return ivec2(resultUV.yx *
vec2(${texShape[0]}, ${texShape[1]}));\n }\n `;\n }\n if (shape[1] === 1) {\n return \n ivec2
getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx * \n vec2(${texShape[0]},
${texShape[1]}));\n int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n return ivec2(index, 0);\n
}\n `;\n }\n if (shape[0] === 1) {\n return \n ivec2 getOutputCoords() {\n ivec2 resTexRC =
ivec2(resultUV.yx * \n vec2(${texShape[0]}, ${texShape[1]}));\n int index = resTexRC.x *
${texShape[1]} + resTexRC.y;\n return ivec2(0,
index);\n }\n `;\n }\n }\n return \n ivec2 getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx * \n
vec2(${texShape[0]}, ${texShape[1]}));\n int index = resTexRC.x * ${texShape[1]} +
resTexRC.y;\n int r = index / ${shape[1]};\n int c = index - r * ${shape[1]};\n return ivec2(r, c);\n }\n
`;\n\n\nfunction getFlatOffsetUniformName(texName: string): string {\n return
`offset${texName}`;\n}\n\nfunction getPackedSamplerScalar(inputInfo: InputInfo): string {\n const texName =
inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n const glsl =
getGlslDifferences();\n return \n vec4 ${funcName}() {\n return ${glsl.texture2D}(${texName}, halfCR);\n
}\n `;\n}\n\nfunction getSamplerScalar(inputInfo: InputInfo): string {\n const texName = inputInfo.name;\n const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n if (inputInfo.shapeInfo.isUniform)
{\n return `float ${funcName}() {return ${texName};}`;\n }\n const [texNumR, texNumC] =
inputInfo.shapeInfo.texShape;\n if (texNumR === 1 && texNumC === 1) {\n return \n float ${funcName}()
{\n return sampleTexture(${texName}, halfCR);\n }\n `;\n }\n const [tNumR, tNumC] =
inputInfo.shapeInfo.texShape;\n const offset = getFlatOffsetUniformName(texName);\n return \n float
${funcName}() {\n vec2 uv = uvFromFlat(${tNumR}, ${tNumC}, ${offset});\n return
sampleTexture(${texName}, uv);\n }\n `;\n}\n\nfunction getPackedSampler1D(inputInfo: InputInfo): string {\n
const texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() +
texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n const packedTexShape = \n
[Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const glsl = getGlslDifferences();\n\n return \n vec4
${funcName}(int index) {\n vec2 uv = packedUVfrom1D(\n
 ${packedTexShape[0]}, ${packedTexShape[1]}, index);\n return ${glsl.texture2D}(${texName}, uv);\n
}\n `;\n}\n\nfunction getSampler1D(inputInfo: InputInfo): string {\n const texName = inputInfo.name;\n const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n\n if (inputInfo.shapeInfo.isUniform)
{\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n return \n float ${funcName}(int
index) {\n ${getUniformSampler(inputInfo)}\n }\n `;\n }\n const texShape =
inputInfo.shapeInfo.texShape;\n const tNumR = texShape[0];\n const tNumC = texShape[1];\n\n if (tNumC === 1

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&& tNumR === 1) {\n return \n float ${funcName}(int index) {\n return sampleTexture(${texName},\n halfCR);\n }\n \n }\n const offset = getFlatOffsetUniformName(texName);\n if (tNumC === 1) {\n return\n \n float ${funcName}(int index) {\n \n vec2 uv = vec2(0.5, (float(index + ${offset}) + 0.5) / ${tNumR}.0);\n \n return sampleTexture(${texName}, uv);\n }\n \n }\n if (tNumR === 1) {\n return \n \n float\n ${funcName}(int index) {\n \n vec2 uv = vec2((float(index + ${offset}) + 0.5) / ${tNumC}.0, 0.5);\n \n return\n sampleTexture(${texName}, uv);\n }\n \n }\n return \n \n float ${funcName}(int index) {\n \n vec2 uv =\n uvFromFlat(${tNumR}, ${tNumC}, index + ${offset});\n \n return sampleTexture(${texName}, uv);\n }\n \n }\n \n }\n\nfunction getPackedSampler2D(inputInfo: InputInfo): string {\n const shape =\n inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +\n texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n\n const\n texNumR = texShape[0];\n const texNumC = texShape[1];\n const glsl = getGlslDifferences();\n if (texShape !=\n null && util.arraysEqual(shape, texShape)) {\n return \n \n vec4 ${funcName}(int row, int col) {\n \n vec2 uv\n = (vec2(col,\n row) + halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n \n return ${glsl.texture2D}(${texName}, uv);\n }\n \n }\n\n const packedTexShape = [\n Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const\n valuesPerRow = Math.ceil(shape[1] / 2);\n\n return \n \n vec4 ${funcName}(int row, int col) {\n \n vec2 uv =\n packedUVfrom2D(${valuesPerRow}, ${packedTexShape[0]}, ${\n packedTexShape[1]}, row, col);\n \n return\n ${glsl.texture2D}(${texName}, uv);\n }\n \n }\n\n}\n\nfunction getSampler2D(inputInfo: InputInfo): string {\n const\n shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +\n texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n\n if\n (texShape != null && util.arraysEqual(shape, texShape)) {\n const texNumR = texShape[0];\n const texNumC =\n texShape[1];\n return \n \n float ${funcName}(int row, int col) {\n \n vec2 uv = (vec2(col,\n row) + halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n \n return sampleTexture(${texName}, uv);\n }\n \n }\n\n const {\n newShape, keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if\n (squeezedShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n const\n params = ['row', 'col'];\n return \n \n ${getSamplerFromInInfo(newInputInfo)}\n \n float ${funcName}(int\n row, int col) {\n \n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n \n }\n\n if\n (inputInfo.shapeInfo.isUniform) {\n \n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n \n return \n \n float ${funcName}(int row, int col) {\n \n int index = round(dot(vec2(row, col), vec2(${shape[1]},\n 1)));\n \n ${getUniformSampler(inputInfo)}\n }\n \n }\n\n const texNumR = texShape[0];\n const\n texNumC = texShape[1];\n const offset = getFlatOffsetUniformName(texName);\n if (texNumC\n === 1) {\n \n // index is used directly as physical (no risk of float16 overflow).\n \n return \n \n float\n ${funcName}(int row, int col) {\n \n float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n \n \n vec2 uv = vec2(0.5, (index + 0.5) / ${texNumR}.0);\n \n return sampleTexture(${texName}, uv);\n }\n \n }\n\n if\n (texNumR === 1) {\n \n // index is used directly as physical (no risk of float16 overflow).\n \n return \n \n float\n ${funcName}(int row, int col) {\n \n float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n \n \n vec2 uv = vec2((index + 0.5) / ${texNumC}.0, 0.5);\n \n return sampleTexture(${texName}, uv);\n }\n \n }\n\n return \n \n float ${funcName}(int row, int col) {\n \n // Explicitly use integer operations as dot() only works on\n floats.\n \n int index = row * ${shape[1]} + col + ${offset};\n \n \n vec2 uv = uvFromFlat(${texNumR}, ${texNumC},\n index);\n \n return sampleTexture(${texName}, uv);\n }\n \n }\n\n}\n\nfunction\n getPackedSampler3D(inputInfo: InputInfo): string {\n const\n shape = inputInfo.shapeInfo.logicalShape;\n const\n texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n const\n texShape = inputInfo.shapeInfo.texShape;\n const packedTexShape = [\n Math.ceil(texShape[0] / 2),\n Math.ceil(texShape[1] / 2)];\n\n if\n (shape[0] === 1) {\n const squeezedShape = shape.slice(1);\n const\n keptDims = [1, 2];\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n const\n params = ['b', 'row',\n 'col'];\n return \n \n ${getPackedSamplerFromInInfo(newInputInfo)}\n \n vec4 ${funcName}(int b, int row,\n int col) {\n \n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n \n }\n\n const\n texNumR = packedTexShape[0];\n const texNumC = packedTexShape[1];\n\n const\n valuesPerRow =

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Math.ceil(shape[2] / 2);\n const texelsInBatch = valuesPerRow * Math.ceil(shape[1] / 2);\n const glsl
= getGslIDifferences();\n return \n vec4 ${funcName}(int b, int row, int col) {\n vec2 uv =
packedUVfrom3D(\n ${texNumR}, ${texNumC}, ${texelsInBatch}, ${valuesPerRow}, b, row, col);\n
return ${glsl.texture2D}(${texName}, uv);\n }\n\nfunction getSampler3D(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride0 = shape[1] * shape[2];\n const stride1 =
shape[2];\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if
(squeezedShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n
const params = ['row', 'col', 'depth'];\n return \n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth) {\n return ${funcName}(${getSqueezedParams(params,
keptDims)});\n
 }\n }\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of
float16 overflow).\n return \n float ${funcName}(int row, int col, int depth) {\n int index =
round(dot(vec3(row, col, depth),\n vec3(${stride0}, ${stride1}, 1)));\n
${getUniformSampler(inputInfo)}\n }\n }\n\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n if
(texNumC === stride0 && flatOffset === null) {\n // texC is used directly as physical (no risk of float16
overflow).\n return \n float ${funcName}(int row, int col, int depth) {\n float texR = float(row);\n
float texC = dot(vec2(col, depth), vec2(${stride1}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR) ^\n
vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName},
uv);\n }\n }\n\n if (texNumC === stride1 && flatOffset === null) {\n // texR is used directly as
physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth) {\n
float texR = dot(vec2(row, col), vec2(${shape[1]}, 1));\n float texC = float(depth);\n vec2 uv = (vec2(texC, texR) +
halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n }\n\n
const offset = getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth)
{\n // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col *
${stride1} + depth + ${offset};\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index);\n return
sampleTexture(${texName}, uv);\n }\n }\n\nfunction getPackedSamplerND(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n
const rank = shape.length;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n const
packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const texNumR =
packedTexShape[0];\n const texNumC = packedTexShape[1];\n\n const valuesPerRow = Math.ceil(shape[rank - 1]
/ 2);\n let texelsInBatch = valuesPerRow * Math.ceil(shape[rank - 2] / 2);\n let params = `int b, int row, int col`;\n
let index = `b * ${texelsInBatch} + (row / 2) * ${valuesPerRow} + (col / 2)`;\n for (let b = 2; b < rank - 1; b++) {\n
params = `int b${b}, ` + params;\n texelsInBatch *= shape[rank - b - 1];\n index = `b${b} * ${texelsInBatch} +
` + index;\n }\n const glsl = getGslIDifferences();\n return \n vec4 ${funcName}(${params}) {\n int index =
${index};\n int texR = index / ${texNumC};\n int texC = index - texR * ${texNumC};\n
vec2 uv = (vec2(texC, texR) + halfCR) / vec2(${texNumC}, ${texNumR});\n return
${glsl.texture2D}(${texName}, uv);\n }\n\nfunction getSampler4D(inputInfo: InputInfo): string {\n const
shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride2 = shape[3];\n const stride1 = shape[2] *
stride2;\n const stride0 = shape[1] * stride1;\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n if
(newShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const
params = ['row', 'col', 'depth', 'depth2'];\n return \n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth, int depth2) {\n return ${funcName}(${getSqueezedParams(params,
keptDims)});\n }\n }\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than
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risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n int
index = round(dot(vec4(row, col, depth, depth2),\n vec4(${stride0}, ${stride1}, ${stride2}, 1));\n
${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n const
texShape = inputInfo.shapeInfo.texShape;\n const texNumR = texShape[0];\n const texNumC = texShape[1];\n\n
if (texNumC === stride0 && flatOffset == null) {\n // texC is used directly as physical (no risk of float16
overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n float texR =
float(row);\n float texC =\n dot(vec3(col, depth, depth2),\n vec3(${stride1}, ${stride2}, 1));\n
vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return
sampleTexture(${texName}, uv);\n }\n
`;\n }\n\n if (texNumC === stride2 && flatOffset == null) {\n // texR is used directly as physical (no risk of
float16 overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n float texR =
dot(vec3(row, col, depth),\n vec3(${shape[1]} * shape[2]}, ${shape[2]}, 1));\n float texC =
float(depth2);\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n
return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n const offset =
getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n
// Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col *
${stride1} +\n depth * ${stride2} + depth2;\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index +
${offset});\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\nfunction getSampler5D(inputInfo:
InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride3 = shape[4];\n const
stride2 = shape[3] * stride3;\n const stride1 = shape[2] * stride2;\n const stride0 = shape[1] * stride1;\n\n const
{newShape, keptDims} = util.squeezeShape(shape);\n if (newShape.length < shape.length) {\n const
newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const params = ['row', 'col', 'depth', 'depth2', 'depth3'];\n
return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int row, int col, int depth, int
depth2, int depth3) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n `;\n }\n\n
if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n
return \n float ${funcName}(int row, int col, int depth,
int depth2, int depth3) {\n float index = dot(\n vec4(row, col, depth, depth2),\n vec4(${stride0},
${stride1}, ${stride2}, ${stride3})) +\n depth3;\n ${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n
const flatOffset = inputInfo.shapeInfo.flatOffset;\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n\n if (texNumC === stride0 && flatOffset == null) {\n
// texC is used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int
col, int depth, int depth2, int depth3) {\n int texR = row;\n float texC = dot(vec4(col, depth, depth2,
depth3),\n vec4(${stride1}, ${stride2}, ${stride3}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR)
/\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n
}\n\n if (texNumC === stride3 &&
flatOffset == null) {\n // texR is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col, int depth, int depth2, int depth3) {\n float texR = dot(\n vec4(row, col,
depth, depth2),\n vec4(${shape[1]} * shape[2] * shape[3]},\n ${shape[2]} * shape[3]}, ${shape[3]},
1));\n int texC = depth3;\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0,
${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n const offset =
getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth, int depth2, int
depth3) {\n // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} +
col * ${stride1} + depth * ${stride2} +\n depth2 * ${stride3} + depth3 + ${offset};\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index);\n return sampleTexture(${texName},
uv);\n }\n `;\n }\n\nfunction getSampler6D(inputInfo: InputInfo): string {\n const shape =
inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n\n const {newShape, keptDims} =

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util.squeezeShape(shape);\n if (newShape.length < shape.length) {\n const newInputInfo =
squeezeInputInfo(inputInfo, newShape);\n const params = ['row', 'col', 'depth', 'depth2', 'depth3', 'depth4'];\n
return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int row, int col, int depth,\n
 int depth2, int depth3, int depth4) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n
}\n `;\n }\n\n const stride4 = shape[5];\n const stride3 = shape[4] * stride4;\n const stride2 = shape[3] *
stride3;\n const stride1 = shape[2] * stride2;\n const stride0 = shape[1] * stride1;\n\n if
(inputInfo.shapeInfo.isUniform) {\n //
Uniform arrays will be less than 65505 (no risk of float16 overflow).\n return \n float ${funcName}(int row,\n
int col, int depth,\n
 int depth2, int depth3, int depth4) {\n int index = round(dot(\n vec4(row,\n
col, depth, depth2),\n vec4(${stride0}, ${stride1}, ${stride2}, ${stride3})) +\n dot(\n
vec2(depth3, depth4),\n vec2(${stride4}, 1));\n ${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n
const flatOffset = inputInfo.shapeInfo.flatOffset;\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n if (texNumC === stride0 && flatOffset === null) {\n
// texC is used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int
col, int depth,\n
 int depth2, int depth3, int depth4) {\n int texR = row;\n float texC =
dot(vec4(col, depth, depth2, depth3),\n
 vec4(${stride1}, ${stride2}, ${stride3}, ${stride4})) +\n float(depth4);\n vec2 uv = (vec2(texC,\n
texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName},
uv);\n }\n `;\n }\n\n if (texNumC === stride4 && flatOffset === null) {\n // texR is used directly as physical
(no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth,\n
 int
depth2, int depth3, int depth4) {\n float texR = dot(vec4(row, col, depth, depth2),\n vec4(${shape[1] *
shape[2] * shape[3] * shape[4]},\n ${shape[2] * shape[3] * shape[4]},\n ${shape[3] * shape[4]},\n
${shape[4]})) + float(depth3);\n int texC = depth4;\n vec2 uv = (vec2(texC, texR) + halfCR) /\n
vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n
const offset = getFlatOffsetUniformName(texName);\n
return \n float ${funcName}(int row, int col, int depth,\n
 int depth2, int depth3, int depth4) {\n //
Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col * ${stride1}
+ depth * ${stride2} +\n
 depth2 * ${stride3} + depth3 * ${stride4} + depth4 + ${offset};\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index);\n return sampleTexture(${texName}, uv);\n }\n
`;\n }\n\n\nfunction getUniformSampler(inputInfo: InputInfo): string {\n const texName = inputInfo.name;\n const
inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape);\n\n if (inSize < 2) {\n return `return
${texName}`;\n }\n\n return \n for (int i = 0; i < ${inSize}; i++) {\n if (i === index) {\n return
${texName}[i];\n }\n }\n `;\n }\n\n\nfunction getPackedSamplerAtOutputCoords(\n inputInfo: InputInfo,\n
outShapeInfo: ShapeInfo) {\n const texName = inputInfo.name;\n const
texFuncSnippet = texName.charAt(0).toUpperCase() + texName.slice(1);\n const funcName = 'get' +
texFuncSnippet + 'AtOutCoords';\n const inRank = inputInfo.shapeInfo.logicalShape.length;\n const outRank =
outShapeInfo.logicalShape.length;\n\n const broadcastDims = getBroadcastDims(\n
inputInfo.shapeInfo.logicalShape, outShapeInfo.logicalShape);\n\n const type = getCoordsDataType(outRank);\n
const rankDiff = outRank - inRank;\n let coordsSnippet: string;\n const fields = ['x', 'y', 'z', 'w', 'u', 'v'];\n\n if
(inRank === 0) {\n coordsSnippet = ";\n } else if (outRank < 2 && broadcastDims.length >= 1) {\n
coordsSnippet = 'coords = 0;';\n } else {\n coordsSnippet =\n broadcastDims.map(d => `coords.${fields[d +
rankDiff]} = 0;`)\n .join("\\n");\n }\n\n let unpackedCoordsSnippet = ";\n if (outRank < 2 && inRank > 0) {\n
unpackedCoordsSnippet = 'coords';\n } else {\n unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape\n
 .map((s, i) => `coords.${fields[i + rankDiff]}`)\n .join(',');\n }\n\n let output =
`return outputValue;`\n const inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape);\n const
isInputScalar = inSize === 1;\n const outSize = util.sizeFromShape(outShapeInfo.logicalShape);\n const
isOutputScalar = outSize === 1;\n\n if (inRank === 1 && !isInputScalar && !isOutputScalar) {\n output = `

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/**\n * Affects what type of texture we allocate for the output. Defaults to\n * `TextureUsage.RENDER`. \n */\n outTexUsage?: TextureUsage;\n /**\n * The type of scheme to use when packing texels for the output values.\n * See `PackingScheme` for details. Defaults to `PackingScheme.SHARED_BATCH`. \n */\n outPackingScheme?: PackingScheme;\n}\n\nexport interface GPGPUBinary {\n webGLProgram: WebGLProgram;\n program: GPGPUProgram;\n uniformLocations: {[name: string]: WebGLUniformLocation};\n source: string;\n inShapeInfos: ShapeInfo[];\n outShapeInfo: ShapeInfo;\n infLoc: WebGLUniformLocation;\n nanLoc: WebGLUniformLocation;\n}\n\nexport interface TensorData {\n shape: number[];\n texData: TextureData;\n isUniform: boolean;\n // Available when we decide to upload as uniform instead of texture.\n uniformValues?: TypedArray;\n}\n\nexport function compileProgram<T extends Tensor, K extends Tensor>(\n gpgpu: GPGPUContext, program: GPGPUProgram, inputs: TensorData[],\n output: TensorData): GPGPUBinary {\n const userCode = program.userCode;\n const inputInfos: InputInfo[] = inputs.map((input, i) => {\n const shapeInfo: ShapeInfo = {\n logicalShape: input.shape,\n texShape: input.isUniform ? null :\n input.texData.texShape,\n isUniform: input.isUniform,\n isPacked: input.isUniform ? false :\n input.texData.isPacked,\n flatOffset: null\n };\n if (input.texData\n != null && input.texData.slice != null &&\n input.texData.slice.flatOffset > 0) {\n shapeInfo.flatOffset =\n input.texData.slice.flatOffset;\n }\n return {name: program.variableNames[i], shapeInfo};\n });\n const inShapeInfos = inputInfos.map(x => x.shapeInfo);\n const outShapeInfo: ShapeInfo = {\n logicalShape: output.shape,\n texShape: output.texData.texShape,\n isUniform: false,\n isPacked: output.texData.isPacked,\n flatOffset: null\n };\n const source = shader_compiler.makeShader(\n inputInfos, outShapeInfo, userCode,\n program.packedInputs);\n const webGLProgram = gpgpu.createProgram(source);\n // Add special uniforms (NAN, INFINITY)\n let infLoc: WebGLUniformLocation = null;\n const nanLoc =\n gpgpu.getUniformLocation(webGLProgram, 'NAN', false);\n if (env().getNumber('WEBGL_VERSION') === 1)\n {\n infLoc = gpgpu.getUniformLocation(webGLProgram, 'INFINITY', false);\n }\n // Add user-defined uniforms\n const uniformLocations: {[name: string]: WebGLUniformLocation} = {};\n for (let i = 0; i < program.variableNames.length; i++) {\n const varName = program.variableNames[i];\n const shouldThrow = false;\n uniformLocations[varName] =\n gpgpu.getUniformLocation(webGLProgram, varName, shouldThrow);\n uniformLocations[`${varName}`\n] =\n gpgpu.getUniformLocation(webGLProgram, `offset${varName}`,\n shouldThrow);\n }\n return {\n program,\n source,\n webGLProgram,\n uniformLocations,\n inShapeInfos,\n outShapeInfo,\n infLoc,\n nanLoc,\n };\n}\n\nfunction validateBinaryAndProgram(\n shapeInfos: ShapeInfo[], inputs: TensorData[]) {\n if (shapeInfos.length !== inputs.length) {\n throw Error(\n `Binary was compiled with ${shapeInfos.length}\n inputs, but `${inputs.length}` was executed with\n ${inputs.length} inputs`);\n }\n shapeInfos.forEach((s, i) => {\n const shapeA = s.logicalShape;\n const input = inputs[i];\n const shapeB = input.shape;\n if (!util.arraysEqual(shapeA, shapeB)) {\n throw Error(\n `Binary was compiled with different shapes\n than `${shapeA}` the current args. Shapes\n ${shapeA} and ${shapeB} must match`);\n }\n // The input is uploaded as uniform.\n if (s.isUniform && input.isUniform) {\n return;\n }\n const texShapeA = s.texShape;\n const texShapeB = input.isUniform ? null :\n input.texData.texShape;\n if (!util.arraysEqual(texShapeA,\n texShapeB)) {\n throw Error(\n `Binary was compiled with different texture shapes\n than the `${texShapeA}` current args. Shape\n ${texShapeA} and ${texShapeB} must match`);\n }\n });\n}\n\nexport function runProgram<T extends Tensor, K extends Tensor>(\n gpgpu: GPGPUContext, binary: GPGPUBinary, inputs: TensorData[],\n output: TensorData,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram: WebGLProgram)\n => void): void {\n validateBinaryAndProgram(binary.inShapeInfos, inputs);\n validateBinaryAndProgram([binary.outShapeInfo],\n [output]);\n const outTex = output.texData.texture;\n const outTexShape = output.texData.texShape;\n if (output.texData.isPacked) {\n gpgpu.setOutputPackedMatrixTexture(outTex, outTexShape[0],\n outTexShape[1]);\n } else {\n gpgpu.setOutputMatrixTexture(outTex, outTexShape[0],\n outTexShape[1]);\n }\n gpgpu.setProgram(binary.webGLProgram);\n // Set special uniforms (NAN, INFINITY)\n if (env().getNumber('WEBGL_VERSION') === 1) {\n if (binary.infLoc !== null) {\n
```

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gpgpu.gl.uniform1f(binary.infLoc, Infinity);\n }\n }\n if (binary.nanLoc !== null) {\n
gpgpu.gl.uniform1f(binary.nanLoc, NaN);\n }\n\n // Set user-defined inputs\n inputs.forEach((input, i) => {\n
const varName = binary.program.variableNames[i];\n const varLoc = binary.uniformLocations[varName];\n
const varOffsetLoc = binary.uniformLocations[`${varName}_offset`];\n\n if (varLoc == null) {\n // The
compiler inferred that this variable is not used
in this shader.\n return;\n }\n\n if (input.isUniform) {\n // Upload the values of the tensor as uniform.\n
if (util.sizeFromShape(input.shape) < 2) {\n gpgpu.gl.uniform1f(varLoc, input.uniformValues[0]);\n } else
{\n let vals = input.uniformValues;\n if (!(vals instanceof Float32Array)) {\n vals = new
Float32Array(vals);\n }\n gpgpu.gl.uniform1fv(varLoc, vals);\n }\n return;\n }\n\n // If the input
was sliced, upload the flat offset index.\n if (input.texData.slice != null && varOffsetLoc != null) {\n
gpgpu.gl.uniform1i(varOffsetLoc, input.texData.slice.flatOffset);\n }\n\n
gpgpu.setInputMatrixTexture(input.texData.texture, varLoc, i);\n });\n\n if (customSetup != null) {\n
customSetup(gpgpu, binary.webGLProgram);\n }\n gpgpu.executeProgram();\n }\n\n\nexport function
makeShaderKey(\n program: GPGPUProgram, inputs: TensorData[], output: TensorData): string {\n let keyInputs
=
";\n inputs.concat(output).forEach(x => {\n const hasOffset = x.texData != null && x.texData.slice != null &&\n
x.texData.slice.flatOffset > 0;\n const texShape = x.isUniform ? 'uniform' : x.texData.texShape;\n keyInputs
+= `${x.shape}_${texShape}_${hasOffset}`;\n });\n const keyUserCode = program.userCode;\n let key =
program.constructor.name;\n // Fast string concat. See https://jsperf.com/string-concatenation/14.\n key += '_' +
keyInputs + '_' + keyUserCode;\n return key;\n }\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\n\nexport function assertNotComplex(\n tensor:
TensorInfo|TensorInfo[], opName: string): void {\n if (!Array.isArray(tensor)) {\n tensor = [tensor];\n }\n
tensor.forEach(t => {\n if (t != null) {\n util.assert(\n t.dtype !== 'complex64',\n () => `${\n
opName} does not support complex64 tensors in the CPU backend.`);\n }\n });\n }\n\n", "/*\n * @license\n *
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Abs, AbsInputs, KernelConfig, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nimport {assertNotComplex} from
'./cpu_util';\n\nexport function simpleAbsImpl(vals: TypedArray): Float32Array {\n const resultValues = new
Float32Array(vals.length);\n for (let i = 0; i < vals.length; ++i) {\n resultValues[i] = Math.abs(vals[i]);\n }\n
return resultValues;\n }\n\nexport const abs = (args: {inputs: AbsInputs, backend: MathBackendCPU}) => {\n const
{x} = args.inputs;\n const cpuBackend = args.backend;\n\n assertNotComplex(x, 'abs');\n\n
let resultValues = new Float32Array(util.sizeFromShape(x.shape));\n const values =
cpuBackend.data.get(x.dataId).values as TypedArray;\n resultValues = simpleAbsImpl(values);\n\n return
cpuBackend.makeOutput(resultValues, x.shape, 'float32');\n }\n\nexport const absConfig: KernelConfig = {\n

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kernelName: Abs,\n backendName: 'cpu',\n kernelFunc: abs as { } as KernelFunc,\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the\n \* \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the\n \* License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or\n \* agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for\n \* the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { backend_util, DataType, NumericDataType, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { SimpleBinaryKernelImpl, SimpleBinaryOperation } from './binary_types';\n\n/**\n * Template that creates implementation for binary ops. Supports broadcast.\n */\nexport function createSimpleBinaryKernelImpl(op: SimpleBinaryOperation):\n SimpleBinaryKernelImpl {\n return (aShape: number[], bShape: number[], aVals: TypedArray,\n bVals: TypedArray, dtype: DataType): [TypedArray, number[]] => {\n const newShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n const resultRank = newShape.length;\n const resultStrides = util.computeStrides(newShape);\n const resultSize = util.sizeFromShape(newShape);\n\n const result =\n util.getTypedArrayFromDType(dtype as NumericDataType, resultSize);\n\n const aRank = aShape.length;\n\n const bRank = bShape.length;\n const aStrides = util.computeStrides(aShape);\n const bStrides = util.computeStrides(bShape);\n\n const aBroadcastDims = backend_util.getBroadcastDims(aShape, newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(bShape, newShape);\n\n if (aBroadcastDims.length + bBroadcastDims.length === 0) {\n for (let i = 0; i < result.length; ++i) {\n result[i] = op(aVals[i % aVals.length], bVals[i % bVals.length]);\n }\n } else {\n for (let i = 0; i < result.length; ++i) {\n const loc = util.indexToLoc(i, resultRank, resultStrides);\n const aLoc = loc.slice(-aRank);\n aBroadcastDims.forEach(d => aLoc[d] = 0);\n const aIndex = util.locToIndex(aLoc, aRank, aStrides);\n\n const bLoc = loc.slice(-bRank);\n bBroadcastDims.forEach(d => bLoc[d] = 0);\n const bIndex = util.locToIndex(bLoc, bRank, bStrides);\n\n result[i] = op(aVals[aIndex], bVals[bIndex]);\n }\n }\n\n return [result, newShape];\n };\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\n\nimport { Complex, ComplexInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray } from '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from '../backend_cpu';\n\nexport function complex(args: { inputs: ComplexInputs, backend: MathBackendCPU }):\n TensorInfo {\n const { inputs, backend } = args;\n const { real, imag } = inputs;\n\n const realVals = backend.data.get(real.dataId).values as TypedArray;\n const imagVals = backend.data.get(imag.dataId).values as TypedArray;\n\n const complexInfo = backend.makeTensorInfo(real.shape, 'complex64');\n\n const complex = backend.data.get(complexInfo.dataId);\n\n // The complex tensor owns the underlying real and imag tensorInfos, only the\n // complex tensor tracks refCount, when complexData is disposed the\n // underlying tensorData will be disposed.\n complex.complexTensorInfos = {\n real: backend.makeTensorInfo(real.shape, 'float32', realVals),\n imag: backend.makeTensorInfo(imag.shape, 'float32', imagVals)\n };\n\n return complexInfo;\n}\n\nexport const complexConfig: KernelConfig = {\n kernelName: Complex,\n backendName: 'cpu',\n kernelFunc: complex as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
```

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```
=====\n*\n\nimport {DataType, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\nimport {complex} from './kernels/Complex';\n\n/**\n * Generates a tensorInfo with all zeros value.\n * @param backend cpu backend.\n * @param shape Shape for the zeros tensor.\n * @param dtype Optional. If set, the
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result has this dtype.\n\nexport function zeros(\n backend: MathBackendCPU, shape: number[],\n dtype: DataType = 'float32'): TensorInfo {\n if (dtype === 'complex64') {\n const real = zeros(backend, shape, 'float32');\n const imag = zeros(backend, shape, 'float32');\n return complex({inputs: {real, imag}, backend});\n }\n\n const values = util.makeZerosTypedArray(util.sizeFromShape(shape), dtype);\n return backend.makeTensorInfo(shape, dtype, values);\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\n\nexport function identity(\n args: {inputs: IdentityInputs, backend: MathBackendCPU}): TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: x.shape, dtype: x.dtype};\n}\n\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'cpu',\n kernelFunc: identity as {\n } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain
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a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Real, RealInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\n\nexport function real(args: {inputs: RealInputs, backend: MathBackendCPU}):\n TensorInfo {\n const {inputs, backend} = args;\n const {input} = inputs;\n const real = backend.data.get(input.dataId).complexTensorInfos.real;\n const realVal = backend.data.get(real.dataId).values;\n\n // When complex tensor is disposed, its underlying parts will
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be disposed too.\n // Make new tensor out of the real value of the complex. This makes sure the\n // value is still accessible even if complex tensor is disposed.\n return backend.makeTensorInfo(real.shape, real.dtype, realVal);\n}\n\nexport const realConfig: KernelConfig = {\n kernelName: Real,\n backendName: 'cpu',\n kernelFunc: real as {\n } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
```

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*\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util} from
'@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\nimport
{createSimpleBinaryKernelImpl} from './utils/binary_impl';\nimport {zeros} from './utils/zeros_impl';\nimport
{complex} from './Complex';\nimport {identity} from './Identity';\nimport {real} from './Real';\n\nexport function
cast(\n args: {inputs: CastInputs, backend: MathBackendCPU, attrs: CastAttrs});\n TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dtype} = attrs;\n\n // Casting to complex64.\n if
(dtype === 'complex64') {\n if (x.dtype === 'complex64') {\n return identity({inputs: {x}, backend});\n }\n\n const zerosTensorInfo = zeros(backend, x.shape, x.dtype);\n const floatX = cast({inputs: {x}, backend, attrs:
{dtype: 'float32'}});\n\n const result =\n complex({inputs: {real: floatX, imag: zerosTensorInfo}, backend});\n\n backend.disposeIntermediateTensorInfo(zerosTensorInfo);\n backend.disposeIntermediateTensorInfo(floatX);\n\n return result;\n }\n\n // Casting from complex64\n if (x.dtype === 'complex64') {\n const realPart =
real({inputs: {input: x}, backend});\n const result = cast({inputs: {x: realPart}, backend, attrs: {dtype}});\n\n backend.disposeIntermediateTensorInfo(realPart);\n\n return result;\n }\n\n if (!util.hasEncodingLoss(x.dtype,
dtype)) {\n // We don't change the underlying data, since we cast to higher\n // precision.\n const result =
identity({inputs: {x}, backend});\n return {dataId: result.dataId, shape: result.shape, dtype};\n }\n\n if (dtype
=== 'int32') {\n const values = backend.data.get(x.dataId).values as TypedArray;\n const resultValues =
Int32Array.from(values);\n return backend.makeTensorInfo(x.shape, 'int32', resultValues);\n }\n\n if (dtype === 'bool') {\n // This is essentially the result of notEqual(x, 0). We avoid using\n // kernel
notEqual to avoid circular dependency, i.e. binary_utils ->\n // cast -> notEqual -> binary_utils.\n const xVals =
backend.data.get(x.dataId).values as TypedArray;\n const zero = util.toTypedArray([0], x.dtype);\n\n const
[resultData, resultShape] = createSimpleBinaryKernelImpl(\n (a, b) => (a !== b) ? 1 : 0)(x.shape, [], xVals,
zero, 'bool');\n return backend.makeTensorInfo(resultShape, 'bool', resultData);\n }\n\n throw new Error(`Error
in Cast: failed to cast ${x.dtype} to ${dtype}`);\n }\n\nexport const castConfig: KernelConfig = {\n kernelName:
Cast,\n backendName: 'cpu',\n kernelFunc: cast as {} as KernelFunc;\n};\n\n/**\n * @license\n * Copyright 2020
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {backend_util, BinaryInputs, DataType, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-
core';\nimport {MathBackendCPU} from './backend_cpu';\nimport {assertNotComplex} from
'./cpu_util';\nimport {cast} from './kernels/Cast';\nimport {complex} from './kernels/Complex';\nimport
{ComplexBinaryKernelImpl, ComplexBinaryOperation, SimpleBinaryKernelImpl} from './binary_types';\n\n/**\n *
Template that creates a `KernelFunc` for binary ops.\n * @param name Kernel name.\n * @param
binaryKernelImpl A `SimpleBinaryKernelImpl` for the kernel.\n * @param binaryKernelComplexImpl Optional. If
exists, represents a\n * `ComplexBinaryKernelImpl` for the kernel, will be used when input dtype\n * is
`complex64`.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same
dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less, Greater, etc.\n *
\nexport function binaryKernelFunc(\n name: string, simpleImpl: SimpleBinaryKernelImpl,\n complexImpl?:
```

```

ComplexBinaryKernelImpl, dtype?: DataType): KernelFunc {\n if (complexImpl == null) {\n return ({inputs, backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const cpuBackend = backend as MathBackendCPU;\n assertNotComplex([a, b], name);\n const aVals = cpuBackend.data.get(a.dataId).values as TypedArray;\n const bVals = cpuBackend.data.get(b.dataId).values as TypedArray;\n const $dtype = dtype || a.dtype;\n const [resultData, resultShape] =\n simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);\n return cpuBackend.makeTensorInfo(resultShape, $dtype, resultData);\n };\n }\n return ({inputs, backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const cpuBackend = backend as MathBackendCPU;\n if (a.dtype === 'complex64' || b.dtype === 'complex64') {\n const $aComplex = cast(\n {inputs: {x: a}, backend: cpuBackend, attrs: {dtype: 'complex64'}});\n const $aComplexVals = cpuBackend.data.get($aComplex.dataId);\n const aReal = $aComplexVals.complexTensorInfos.real;\n const aImag = $aComplexVals.complexTensorInfos.imag;\n const aRealVals =\n cpuBackend.data.get(aReal.dataId).values as Float32Array;\n const aImagVals =\n cpuBackend.data.get(aImag.dataId).values as Float32Array;\n const $bComplex = cast(\n {inputs: {x: b}, backend: cpuBackend, attrs: {dtype: 'complex64'}});\n const $bComplexVals = cpuBackend.data.get($bComplex.dataId);\n const bReal = $bComplexVals.complexTensorInfos.real;\n const bImag = $bComplexVals.complexTensorInfos.imag;\n const bRealVals =\n cpuBackend.data.get(bReal.dataId).values as Float32Array;\n const bImagVals =\n cpuBackend.data.get(bImag.dataId).values as Float32Array;\n const [resultRealData, resultImagData, resultShape] =\n complexImpl(\n a.shape, b.shape, aRealVals, aImagVals, bRealVals, bImagVals);\n const resultReal =\n cpuBackend.makeTensorInfo(resultShape, 'float32', resultRealData);\n const resultImag =\n cpuBackend.makeTensorInfo(resultShape, 'float32', resultImagData);\n const result = complex(\n {inputs: {real: resultReal, imag: resultImag}, backend: cpuBackend});\n cpuBackend.disposeIntermediateTensorInfo($aComplex);\n cpuBackend.disposeIntermediateTensorInfo($bComplex);\n cpuBackend.disposeIntermediateTensorInfo(resultReal);\n cpuBackend.disposeIntermediateTensorInfo(resultImag);\n return result;\n } else {\n const aVals = cpuBackend.data.get(a.dataId).values as TypedArray;\n const bVals = cpuBackend.data.get(b.dataId).values as TypedArray;\n const $dtype = dtype || a.dtype;\n const [resultData, resultShape] =\n simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);\n return cpuBackend.makeTensorInfo(resultShape, $dtype, resultData);\n };\n };\n} * Template that creates the complex type implementation for binary ops. * Supports broadcast. * \n\nexport function createComplexBinaryKernelImpl(op: ComplexBinaryOperation):\n ComplexBinaryKernelImpl {\n return (aShape: number[], bShape: number[], aRealVals: Float32Array,\n aImagVals: Float32Array, bRealVals: Float32Array,\n bImagVals: Float32Array): [TypedArray, TypedArray, number[]] => {\n const resultShape = backend_util.assertAndGetBroadcastShape(aShape,\n bShape);\n const resultSize = util.sizeFromShape(resultShape);\n const resultRank = resultShape.length;\n const resultStrides = util.computeStrides(resultShape);\n const resultRealVals =\n util.getTypedArrayFromDType('float32', resultSize);\n const resultImagVals =\n util.getTypedArrayFromDType('float32', resultSize);\n const aBroadcastDims =\n backend_util.getBroadcastDims(aShape, resultShape);\n const bBroadcastDims =\n backend_util.getBroadcastDims(bShape, resultShape);\n const aVals =\n backend_util.mergeRealAndImagArrays(aRealVals, aImagVals);\n const bVals =\n backend_util.mergeRealAndImagArrays(bRealVals, bImagVals);\n const aRank = aShape.length;\n const aStrides = util.computeStrides(aShape);\n const bRank = bShape.length;\n const bStrides =\n util.computeStrides(bShape);\n if (aBroadcastDims.length + bBroadcastDims.length === 0) {\n for (let i = 0; i < resultRealVals.length; i++) {\n const aIdx = i % aVals.length;\n const bIdx = i % bVals.length;\n const result =\n op(aVals[aIdx * 2], aVals[aIdx * 2 + 1], bVals[bIdx * 2],\n bVals[bIdx * 2 + 1]);\n resultRealVals[i]

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= result.real;\n resultImagVals[i] = result.imag;\n }\n } else {\n for (let i = 0; i < resultRealVals.length;\n i++) {\n const loc = util.indexToLoc(i, resultRank, resultStrides);\n const aLoc = loc.slice(-aRank);\n aBroadcastDims.forEach(d => aLoc[d] = 0);\n const aIndex = util.locToIndex(aLoc, aRank, aStrides);\n const bLoc = loc.slice(-bRank);\n bBroadcastDims.forEach(d => bLoc[d] = 0);\n const bIndex =\n util.locToIndex(bLoc, bRank, bStrides);\n const opResult =\n op(aVals[aIndex * 2], aVals[aIndex * 2 +\n 1], bVals[bIndex * 2],\n bVals[bIndex * 2 + 1]);\n resultRealVals[i] = opResult.real;\n resultImagVals[i] = opResult.imag;\n }\n }\n return [resultRealVals, resultImagVals, resultShape];\n };\n}\n", "/*\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====
\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl} from\n './utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from\n './utils/binary_utils';\n\nexport\nconst addImpl = createSimpleBinaryKernelImpl(((a, b) => a + b));\nexport const addComplexImpl =\ncreateComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {\n return {real: aReal + bReal, imag: aImag\n+ bImag};\n}));\n\nexport const add = binaryKernelFunc(Add, addImpl, addComplexImpl);\n\nexport const\naddConfig: KernelConfig = {\n kernelName: Add,\n backendName: 'cpu',\n kernelFunc: add\n};\n", "/\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
=====
\n\nimport {buffer, DataType, Rank, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport\nfunction bincountImpl(\n xVals: TypedArray, weightsVals: TypedArray, weightsDtype: DataType,\n weightsShape: number[], size: number): TypedArray {\n const weightsSize = util.sizeFromShape(weightsShape);\n const outVals = util.makeZerosTypedArray(size, weightsDtype) as TypedArray;\n for (let i = 0; i < xVals.length;\n i++) {\n const value = xVals[i];\n if (value < 0) {\n throw new Error('Input x must be non-negative!');\n }\n if (value >= size) {\n continue;\n }\n if (weightsSize > 0) {\n outVals[value] +=\n weightsVals[i];\n } else {\n outVals[value] += 1;\n }\n }\n return outVals;\n}\n\nexport function\nbincountReduceImpl<R extends Rank>(\n xBuf: TensorBuffer<R>,\n weightsBuf: TensorBuffer<R>, size: number,\n binaryOutput = false): TensorBuffer<R> {\n const numRows =\n xBuf.shape[0];\n const numCols = xBuf.shape[1];\n const outBuf = buffer([numRows, size],\n weightsBuf.dtype);\n for (let i = 0; i < numRows; i++) {\n for (let j = 0; j < numCols; j++) {\n const value =\n xBuf.get(i, j);\n if (value < 0) {\n throw new Error('Input x must be non-negative!');\n }\n if (value\n >= size) {\n continue;\n }\n if (binaryOutput) {\n outBuf.set(1, i, value);\n } else {\n if\n (weightsBuf.size > 0) {\n outBuf.set(outBuf.get(i, value) + weightsBuf.get(i, j), i, value);\n } else {\n outBuf.set(outBuf.get(i, value) + 1, i, value);\n }\n }\n }\n }\n return outBuf as\n TensorBuffer<R>;\n}\n", "/\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the \"License\");\n * you may\n not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,

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```
=====\n*\n\nimport {NumericDataType, util} from '@tensorflow/tfjs-core';\nimport {SimpleUnaryImpl, SimpleUnaryOperation} from './unary_types';\n\n/**\n * Template that creates implementation for unary op.\n */\nexport function createSimpleUnaryImpl(op: SimpleUnaryOperation):\n SimpleUnaryImpl {\n return (values, dtype, attrs) => {\n const newValues =\n util.getTypedArrayFromDType(dtype as NumericDataType,\n values.length);\n\n for (let i = 0; i < values.length; ++i) {\n newValues[i] = op(values[i], attrs);\n }\n return newValues;\n };\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport {DataType, KernelFunc, TypedArray, UnaryInputs, util} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\nimport {assertNotComplex} from './cpu_util';\nimport {SimpleUnaryImpl, SimpleUnaryOperation} from './unary_types';\n\n/**\n * Template that creates a `KernelFunc` for unary ops.\n * @param name Kernel name.\n * @param op A `SimpleUnaryOperation` for the kernel.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same dtype as the input. This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf, etc.\n */\nexport function unaryKernelFunc(\n name: string, op: SimpleUnaryOperation, dtype?: DataType): KernelFunc {\n return ({inputs, attrs, backend}) => {\n const {x} = inputs as UnaryInputs;\n assertNotComplex(x, name);\n if (x.dtype === 'string' || dtype === 'string') {\n throw new Error('unaryKernelFunc does not support string input/output');\n }\n\n const cpuBackend = backend as MathBackendCPU;\n const values = cpuBackend.data.get(x.dataId).values as TypedArray;\n const xSize = util.sizeFromShape(x.shape);\n const $dtype = dtype || x.dtype;\n const newValues = util.getArrayFromDType($dtype, xSize);\n for (let i = 0; i < xSize; ++i) {\n newValues[i] = op(values[i], attrs);\n }\n return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n };\n}\n\n/**\n * Template that creates a `KernelFunc` for unary ops from the given\n * `SimpleUnaryImpl`.\n * @param name Kernel name.\n * @param unaryImpl A `SimpleUnaryImpl` that implements the op.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same dtype as the input. This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf, etc.\n */\nexport function unaryKernelFuncFromImpl(\n name: string, unaryImpl: SimpleUnaryImpl, dtype?: DataType): KernelFunc {\n return ({inputs, attrs, backend}) => {\n const {x} = inputs as UnaryInputs;\n assertNotComplex(x, name);\n if (x.dtype === 'string' || dtype === 'string') {\n throw new Error('unaryKernelFunc does not support string input/output');\n }\n\n const cpuBackend = backend as MathBackendCPU;\n const values = cpuBackend.data.get(x.dataId).values as TypedArray;\n const $dtype = dtype || x.dtype;\n const newValues = unaryImpl(values, $dtype, attrs);\n return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n };\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n */\n
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=====\n*\n\nimport { Ceil, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createSimpleUnaryImpl } from\n'./utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\nexport const ceilImpl =\ncreateSimpleUnaryImpl((xi) => Math.ceil(xi));\nexport const ceil = unaryKernelFuncFromImpl(Ceil,\nceilImpl);\nexport const ceilConfig: KernelConfig = {\n kernelName: Ceil,\n backendName: 'cpu',\n kernelFunc:\nceil,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS\n * IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { backend_util, BackendValues, DataType, TypedArray, util } from '@tensorflow/tfjs-core';\nexport\nfunction concatImpl(\n inputs: Array<{ vals: BackendValues, shape: number[]}>, outShape: number[],\n dtype:\n DataType, simplyConcat: boolean): TypedArray|string[] {\n const outVals = util.getArrayFromDType(dtype,\nutil.sizeFromShape(outShape));\n\n if (simplyConcat && dtype !== 'string') {\n // Use built-in TypedArray.set()\n method for speed.\n let offset = 0;\n inputs.forEach(input => {\n const size =\nutil.sizeFromShape(input.shape);\n (outVals as TypedArray).set(input.vals as TypedArray, offset);\n offset\n += size;\n });\n } else {\n let colOffset = 0;\n inputs.forEach(input\n=> {\n const decodedData = dtype === 'string' ?\n backend_util.fromUint8ToStringArray(input.vals as\n Uint8Array[]):\n input.vals as TypedArray;\n let tIdx = 0;\n for (let row = 0; row < input.shape[0];\n ++row) {\n const resIdx = row * outShape[1] + colOffset;\n for (let col = 0; col < input.shape[1]; ++col) {\n outVals[resIdx + col] = decodedData[tIdx++];\n }\n colOffset += input.shape[1];\n }\n });\n\n return outVals;\n }\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an AS IS BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { Exp, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createSimpleUnaryImpl } from\n'./utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\nexport const expImpl =\ncreateSimpleUnaryImpl((xi) => Math.exp(xi));\nexport const exp = unaryKernelFuncFromImpl(Exp,\nexpImpl);\nexport const expConfig: KernelConfig = {\n kernelName: Exp,\n backendName: 'cpu',\n kernelFunc:\nexp,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { Expm1, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createSimpleUnaryImpl } from\n'./utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\nexport const expm1Impl =\ncreateSimpleUnaryImpl((xi) => Math.expm1(xi));\nexport const expm1 = unaryKernelFuncFromImpl(Expm1,\nexpm1Impl);\nexport const expm1Config: KernelConfig = {\n kernelName: Expm1,\n backendName: 'cpu',\n kernelFunc:\nexpm1,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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```
=====\n*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from './utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\nexport const floorImpl = createSimpleUnaryImpl((xi) => Math.floor(xi));\nexport const floor = unaryKernelFuncFromImpl(Floor, floorImpl);\nexport const floorConfig: KernelConfig = {\n kernelName: Floor,\n backendName: 'cpu',\n kernelFunc: floor,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\nexport function gatherV2Impl<R extends Rank, D extends DataType>(\n xBuf: TensorBuffer<R, D>, indicesBuf: TensorBuffer<R, D>,\n flattenOutputShape: number[]): TensorBuffer<R, D> {\n const outBuf = buffer(flattenOutputShape, xBuf.dtype);\n for (let i = 0; i < outBuf.size; ++i) {\n const newLoc = outBuf.indexToLoc(i);\n const originalLoc: number[] = newLoc.slice();\n const batchIdx = originalLoc[0];\n const indicesIdx = originalLoc[2];\n const indicesIndex = indicesBuf.locToIndex([batchIdx, indicesIdx]);\n originalLoc[2] = indicesBuf.values[indicesIndex] as number;\n const originalIndex = xBuf.locToIndex(originalLoc);\n outBuf.values[i] = xBuf.values[originalIndex];\n }\n return outBuf as TensorBuffer<R, D>;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl} from './utils/binary_impl';\nimport {binaryKernelFunc} from './utils/binary_utils';\nexport const greaterImpl =\n createSimpleBinaryKernelImpl((a: number, b: number) => (a > b) ? 1 : 0);\nexport const greater =\n binaryKernelFunc(Greater, greaterImpl, null /* complexImpl */, 'bool');\nexport const greaterConfig: KernelConfig = {\n kernelName: Greater,\n backendName: 'cpu',\n kernelFunc: greater,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from
'./utils/binary_impl';\n\nimport {binaryKernelFunc} from './utils/binary_utils';\n\n\nexport const lessImpl =\ncreateSimpleBinaryKernelImpl((a: number, b: number) => (a < b) ? 1 : 0);\n\nexport const less =\nbinaryKernelFunc(Less, lessImpl, null /* complexImpl */, 'bool');\n\n\nexport const lessConfig: KernelConfig = {\nkernelName: Less,\nbackendName:
'cpu',\nkernelFunc: less\n};\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {TypedArray, util} from '@tensorflow/tfjs-core';\n\n\nexport function linspaceImpl(\nstart: number,
stop: number, num: number): TypedArray {\nconst step = (stop - start) / (num - 1);\n\nconst values =
util.makeZerosTypedArray(num,\n'float32');\nvalues[0] = start;\nfor (let i = 1; i < values.length; i++) {\nvalues[i] = values[i - 1] + step;\n}\n\nreturn values;\n}\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\n\nimport {createSimpleUnaryImpl} from
'./utils/unary_impl';\n\n\nimport
{unaryKernelFuncFromImpl} from './utils/unary_utils';\n\n\nexport const logImpl = createSimpleUnaryImpl((xi) =>
Math.log(xi));\n\n\nexport const log = unaryKernelFuncFromImpl(Log, logImpl);\n\n\nexport const logConfig:
KernelConfig = {\nkernelName: Log,\nbackendName: 'cpu',\nkernelFunc: log,\n};\n\n", /**\n * @license\n *
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\n\nimport {DataType, NumericDataType, TypedArray, util} from '@tensorflow/tfjs-core';\n\n\nexport function
maxImpl(\n aVals: TypedArray, reduceSize: number, outShape: number[],\n dtype: DataType): TypedArray {\nconst
vals = util.getTypedArrayFromDType(\n dtype as NumericDataType, util.sizeFromShape(outShape));\n\n\nfor (let i = 0; i < vals.length; ++i) {\nconst offset = i * reduceSize;\nlet max = aVals[offset];\nfor (let j = 0; j < reduceSize; ++j) {\nconst value = aVals[offset + j];\nif (value > max) {\nmax = value;\n}\n}\nvals[i] = max;\n}\n\nreturn vals;\n}\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law

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```
=====
*
import {KernelConfig, Maximum} from '@tensorflow/tfjs-core';
import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc} from '../utils/binary_utils';
export const maximumImpl = createSimpleBinaryKernelImpl(
 ((aValue, bValue) => Math.max(aValue, bValue)));
export const maximum = binaryKernelFunc(Maximum, maximumImpl);
export const maximumConfig: KernelConfig = {
 kernelName: Maximum,
 backendName: 'cpu',
 kernelFunc: maximum
};
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 * or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 */
=====
```

```
=====
*
import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';
import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc} from '../utils/binary_utils';
export const minimumImpl = createSimpleBinaryKernelImpl(
 ((aValue, bValue) => Math.min(aValue, bValue)));
export const minimum = binaryKernelFunc(Minimum, minimumImpl);
export const minimumConfig: KernelConfig = {
 kernelName: Minimum,
 backendName: 'cpu',
 kernelFunc: minimum
};
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 * permissions and limitations under the License.
 */
=====
```

```
=====
*
import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';
import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc, createComplexBinaryKernelImpl} from
 '../utils/binary_utils';
export const multiplyImpl = createSimpleBinaryKernelImpl(
 ((aValue, bValue) => aValue * bValue));
export const multiplyComplexImpl = createComplexBinaryKernelImpl(
 ((aReal, aImag, bReal, bImag) => {
 return {
 real: aReal * bReal - aImag * bImag,
 imag: aReal * bImag + aImag * bReal
 };
 }));
export const multiply = binaryKernelFunc(Multiply, multiplyImpl,
 multiplyComplexImpl);
export const multiplyConfig: KernelConfig = {
 kernelName: Multiply,
 backendName: 'cpu',
 kernelFunc: multiply
};
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 * or implied. See the License for the specific language governing
 * permissions and limitations under the License.
 */
=====
```

```
=====
*
import {DataType, KernelConfig, KernelFunc, Neg, TensorInfo, TypedArray, UnaryInputs, util} from
 '@tensorflow/tfjs-core';
import {MathBackendCPU} from '../backend_cpu';
import {assertNotComplex} from '../cpu_util';
import {multiplyImpl} from './Multiply';
export function negImpl(xVals: TypedArray, xShape: number[], xDtype: DataType):
 [TypedArray, number[]] {
 const minusOne = util.createScalarValue(-1 as
=====
```

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{ } as 'float32', xDtype) as TypedArray;\n return multiplyImpl([], xShape, minusOne, xVals, xDtype);\n}\n\n\nexport
function neg(args: {inputs: UnaryInputs, backend: MathBackendCPU});\n TensorInfo {\n const {inputs,
backend} = args;\n const {x} =
inputs;\n\n assertNotComplex(x, 'neg');\n\n const xVals = backend.data.get(x.dataId).values as TypedArray;\n
const [res, newShape] = negImpl(xVals, x.shape, x.dtype);\n\n return backend.makeTensorInfo(newShape, x.dtype,
res);\n}\n\n\nexport const negConfig: KernelConfig = {\n kernelName: Neg,\n backendName: 'cpu',\n kernelFunc:
neg as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl}
from '../utils/binary_impl';\nimport {binaryKernelFunc} from '../utils/binary_utils';\n\nexport const notEqualImpl
=\n createSimpleBinaryKernelImpl(((a, b) => (a !== b) ? 1 : 0));\nexport const notEqual =\n
binaryKernelFunc(NotEqual, notEqualImpl, null /* complexOp */, 'bool');\n\nexport const notEqualConfig:
KernelConfig = {\n kernelName: NotEqual,\n backendName: 'cpu',\n kernelFunc: notEqual\n};\n", "/*\n *
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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport {DataType, NumericDataType, TypedArray} from '@tensorflow/tfjs-core';\nimport {util} from
'@tensorflow/tfjs-core';\n\nexport function transposeImpl(\n xVals: TypedArray, xShape: number[], dtype:
DataType, perm: number[],\n newShape: number[]): TypedArray {\n const xRank = xShape.length;\n const xSize
= util.sizeFromShape(xShape);\n const xStrides = util.computeStrides(xShape);\n const newStrides =
util.computeStrides(newShape);\n\n const result = util.getTypedArrayFromDType(\n dtype as
NumericDataType, util.sizeFromShape(newShape));\n\n for (let i = 0; i < xSize; ++i) {\n const loc =
util.indexToLoc(i, xRank, xStrides);\n\n // Permute
location.\n const newLoc: number[] = new Array(loc.length);\n for (let i = 0; i < newLoc.length; i++) {\n
newLoc[i] = loc[perm[i]];\n }\n\n const newIndex = util.locToIndex(newLoc, xRank, newStrides);\n
result[newIndex] = xVals[i];\n }\n return result;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs, TypedArray}
from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from '../backend_cpu';\nimport {assertNotComplex}
from '../cpu_util';\nimport {transposeImpl} from './Transpose_impl';\n\nexport function transpose(args: {\n inputs:
TransposeInputs,\n attrs: TransposeAttrs,\n backend: MathBackendCPU\n}): TensorInfo {\n const {inputs, attrs,

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backend} = args;\n const {x} = inputs;\n const {perm} = attrs;\n\n assertNotComplex(x, 'transpose');\n\n const
xRank = x.shape.length;\n\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length;
i++) {\n newShape[i] = x.shape[perm[i]];\n }\n\n const values = backend.data.get(x.dataId).values as
TypedArray;\n const result = transposeImpl(values, x.shape, x.dtype, perm, newShape);\n\n const dataId =
backend.write(result, newShape, x.dtype);\n return {dataId, shape: newShape, dtype: x.dtype};\n}\n\n\nexport
const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'cpu',\n kernelFunc:
transpose as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {backend_util, DataType, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo,
TypedArray, upcastType, util}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\nimport {assertNotComplex}
from '../cpu_util';\nimport {transpose} from '../Transpose';\n\nexport function prodImpl(\n xShape: number[],
xDtype: DataType, xVals: TypedArray,\n reductionAxes: number[]:\n {outVals: TypedArray, outShape:
number[], outDtype: DataType} {\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(xShape, reductionAxes);\n const outDtype = upcastType(xDtype,
'int32');\n const outVals = util.makeZerosTypedArray(\n util.sizeFromShape(outShape), outDtype) as
TypedArray;\n const reduceSize = util.sizeFromShape(reduceShape);\n\n for (let i = 0; i < outVals.length; ++i) {\n
 const offset = i * reduceSize;\n let prod = 1;\n for (let j = 0; j < reduceSize; ++j) {\n prod *= xVals[offset +
j];\n }\n outVals[i] = prod;\n }\n\n return {outVals, outShape, outDtype};\n}\n\n\nexport function prod(\n args:
{inputs: ProdInputs,
backend: MathBackendCPU, attrs: ProdAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {axis, keepDims} = attrs;\n\n assertNotComplex(x, 'prod');\n\n const xRank =
x.shape.length;\n const axes = util.parseAxisParam(axis, x.shape);\n\n const permutation =
backend_util.getAxesPermutation(axes, xRank);\n let reductionAxes = axes;\n let permutedX = x;\n const
intermediateTensorInfos = [];\n if (permutation != null) {\n permutedX = transpose({inputs: {x}, backend, attrs:
{perm: permutation}});\n intermediateTensorInfos.push(permutedX);\n reductionAxes =
backend_util.getInnerMostAxes(reductionAxes.length, xRank);\n }\n\n const xVals =
backend.data.get(permutedX.dataId).values as TypedArray;\n const {outVals, outShape, outDtype} =\n
prodImpl(permutedX.shape, permutedX.dtype, xVals, reductionAxes);\n\n let resultShape = outShape;\n if
(keepDims) {\n resultShape = backend_util.expandShapeToKeepDim(outShape,
axes);\n }\n\n intermediateTensorInfos.forEach(\n t => backend.disposeIntermediateTensorInfo(t);\n\n return
backend.makeTensorInfo(resultShape, outDtype, outVals);\n}\n\n\nexport const prodConfig: KernelConfig = {\n
kernelName: Prod,\n backendName: 'cpu',\n kernelFunc: prod as {} as KernelFunc\n};\n", "/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {DataTypeMap, util} from '@tensorflow/tfjs-core';\n\nexport function rangeImpl(\n start: number,
stop: number, step: number,\n dtype: 'float32'|'int32'): DataTypeMap['float32' | 'int32'] {\n const sameStartStop =

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start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const
decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop || increasingRangeNegativeStep ||\n
 decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n } \n\n const numElements =
Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\n\n if
(stop < start && step === 1) {\n // Auto adjust the step's sign if it hasn't been set\n // (or was set to 1)\n step = -
1;\n } \n\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n } \n\n
return values;\n } \n\n", "/*\n * @license\n * Copyright
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\n\nimport { createSimpleUnaryImpl } from
'./utils/unary_impl';\n\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\n\nexport const rsqrtImpl =
createSimpleUnaryImpl((xi) => 1 / Math.sqrt(xi));\n\nexport const rsqrt = unaryKernelFuncFromImpl(Rsqrt,
rsqrtImpl);\n\nexport const rsqrtConfig: KernelConfig = {\n kernelName: Rsqrt,\n backendName: 'cpu',\n kernelFunc: rsqrt,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport { backend_util, BackendValues, buffer, DataType, KernelConfig, KernelFunc, Slice, slice_util,
SliceAttrs, SliceInputs, TensorInfo,
TypedArray, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendCPU } from './backend_cpu';\n\nimport
{ assertNotComplex } from './cpu_util';\n\nexport function sliceImpl(\n vals: BackendValues, begin: number[],
size: number[], shape: number[],\n dtype: DataType): BackendValues {\n const isContinuous =
slice_util.isSliceContinuous(shape, begin, size);\n const length = util.sizeFromShape(size);\n const xStrides =
util.computeStrides(shape);\n\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin,
xStrides);\n\n if (dtype === 'string') {\n return (vals as Uint8Array[]).slice(flatOffset, flatOffset + length);\n
}\n\n return (vals as TypedArray).subarray(flatOffset, flatOffset + length);\n } \n\n const decodedData = dtype
=== 'string' ?\n backend_util.fromUint8ToStringArray(vals as Uint8Array[]) : \n vals as TypedArray;\n\n const inBuf = buffer(shape, dtype, decodedData);\n const outBuf = buffer(size, dtype);\n for (let i =
0; i < outBuf.size; ++i) {\n const outLoc = outBuf.indexToLoc(i);\n const inLoc = outLoc.map((idx: number, j)
=> idx + begin[j]);\n outBuf.set(inBuf.get(...inLoc), ...outLoc);\n } \n\n if (dtype === 'string') {\n return
backend_util.fromStringArrayToUint8(outBuf.values as string[]);\n } \n\n return outBuf.values as
TypedArray;\n} \n\nexport function slice(\n args: { inputs: SliceInputs, backend: MathBackendCPU, attrs:
SliceAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { begin, size } =
attrs;\n\n assertNotComplex(x, 'slice');\n\n const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);\n\n slice_util.assertParamsValid(x, $begin, $size);\n\n const vals = backend.data.get(x.dataId).values;\n const outVals
= sliceImpl(vals, $begin, $size, x.shape, x.dtype);\n return backend.makeTensorInfo($size, x.dtype,
outVals);\n} \n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'cpu',\n kernelFunc: slice as { } as KernelFunc;\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
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```
=====\n*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport\n{createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {binaryKernelFunc} from\n '../utils/binary_utils';\n\nexport const squaredDifferenceImpl\n= createSimpleBinaryKernelImpl(((a, b) => {\n const diff = a - b;\n return diff * diff;\n}));\nexport const\nsquaredDifference =\n binaryKernelFunc(SquaredDifference, squaredDifferenceImpl);\n\nexport const\nsquaredDifferenceConfig: KernelConfig = {\n kernelName: SquaredDifference,\n backendName: 'cpu',\n kernelFunc: squaredDifference\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n*\n\nimport {buffer, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\nexport function stridedSliceImpl<R\n extends Rank>(\n outShape: number[], xBuf: TensorBuffer<R>, strides: number[],\n begin: number[]):\n TensorBuffer<R> {\n const outBuf = buffer(outShape, xBuf.dtype);\n for (let i = 0; i < outBuf.size; i++) {\n const loc = outBuf.indexToLoc(i);\n const newLoc: number[] = new Array(loc.length);\n for (let j = 0; j <\n newLoc.length; j++) {\n newLoc[j] = loc[j] * strides[j] + begin[j];\n }\n outBuf.set(xBuf.get(...newLoc),\n ...loc);\n }\n return outBuf as TensorBuffer<R>;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n *
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=====\n*\n\nimport { KernelConfig, Sub } from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl} from\n '../utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from\n '../utils/binary_utils';\n\nexport const subImpl =\n createSimpleBinaryKernelImpl(((aValue, bValue) => aValue -\n bValue));\n\nexport const subComplexImpl =\n createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) =>\n {\n return {real: aReal - bReal, imag: aImag - bImag};\n }));\n\nexport const sub = binaryKernelFunc(Sub,\n subImpl, subComplexImpl);\n\nexport const subConfig:\n KernelConfig = {\n kernelName: Sub,\n backendName: 'cpu',\n kernelFunc: sub\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\n/**\n * An implementation of the tile kernel shared between webgl and cpu for string\n * tensors only.\n\n * An export function tileImpl<R extends Rank>(\n xBuf: TensorBuffer<R, DataType>,\n reps: number[]):\n TensorBuffer<R, DataType> {\n const newShape: number[] = new Array(xBuf.rank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xBuf.shape[i] * reps[i];\n }\n const result = buffer(newShape, xBuf.dtype);\n for (let i = 0; i < result.values.length; ++i) {\n const newLoc = result.indexToLoc(i);\n\n const originalLoc: number[] = new Array(xBuf.rank);\n for (let j = 0; j < originalLoc.length; j++) {\n originalLoc[j] = newLoc[j] % xBuf.shape[j];\n }\n\n const originalIndex = xBuf.locToIndex(originalLoc);\n result.values[i] = xBuf.values[originalIndex];\n }\n return result as TensorBuffer<R, DataType>;\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n\n/**\n * An implementation of the TopK kernel shared between webgl and cpu. *\n\nimport {buffer, NumericDataType, Rank, ShapeMap, Tensor, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function topKImpl<T extends Tensor, R extends Rank>(\n x: TypedArray, xShape: number[], xDtype: NumericDataType, k: number,\n sorted: boolean):\n [TensorBuffer<R, NumericDataType>,\n TensorBuffer<R, 'int32'>] {\n // Reshape into a 2d tensor [batch, lastDim] and compute topk along lastDim.\n const lastDim = xShape[xShape.length - 1];\n const [batch, size] = [x.length / lastDim, lastDim];\n const allTopKVals = util.getTypedArrayFromDType(xDtype, batch * k);\n const allTopKIndices = util.getTypedArrayFromDType('int32', batch * k);\n for (let b = 0; b < batch; b++) {\n const offset = b * size;\n const vals = x.subarray(offset, offset + size);\n const valAndInd: Array<{value: number, index: number}> = [];\n for (let i = 0; i < vals.length; i++) {\n valAndInd.push({value: vals[i], index: i});\n }\n valAndInd.sort((a, b) => b.value - a.value);\n const outOffset = b * k;\n const topKVals = allTopKVals.subarray(outOffset, outOffset + k);\n const topKIndices = allTopKIndices.subarray(outOffset, outOffset + k);\n for (let i = 0; i < k; i++) {\n topKVals[i] = valAndInd[i].value;\n topKIndices[i] = valAndInd[i].index;\n }\n }\n // Reshape back to the original input shape, except that the last\n // dimension is k.\n const outputShape = xShape.slice();\n outputShape[outputShape.length - 1] = k;\n return [\n buffer(outputShape as ShapeMap[R], xDtype, allTopKVals),\n buffer(outputShape as ShapeMap[R], 'int32', allTopKIndices)\n];\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n\nimport {BackendValues, DataType, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function uniqueImpl(\n values: BackendValues, axis: number, shape: number[], dtype: DataType):\n {outputValues: BackendValues,\n outputShape: number[],\n indices: BackendValues} {\n // Normalize and validate axis.\n const $axis = util.parseAxisParam(axis, shape)[0];\n // Calculate the new shape that is suitable for extracting data along the\n // given axis.\n // The rank is 3.\n // The size of the 1st dimension is the size of all the axes < the given axis.\n // The size of the 2nd dimension is the same as the size of the given axis.\n // The size of the 3rd dimension is the size of all the axes > the given axis.\n // For example, for a 4D tensor with shape=[2, 3, 5, 4] and axis=2, the\n // newShape would be: [2*3, 5, 4].\n // Note that this is not the final output shape. This will be the shape for an\n // intermediate TensorBuffer (see inputBuffer

```

below) to allow us to extract

the given axis. To demonstrate how it works, consider the following example: Input: a 3D tensor, with shape [1, 2, 3] along axis 2 (the last axis). Along axis 2, we expect to extract 3 tensors: [1,4], [2,5], [3,6]. For this example, newShape would be: [2, 3, 1], where 2 is calculated from 1\*2. The re-shaped data would look like: [1], [2], [3], [4], [5], [6]. Then, we can construct a 3-level nested loop by the following dimension order to extract the values along the axis (dimension1):

```
// m: dimension0 // 0,1 (newShape[0]) // n: dimension2 // 0 (newShape[2])
// m, i, n ----- Iteration 0: data at [0, 0, 0] => "1" Iteration 1:
// data at [1, 0, 0] => "4" We got [1,4] Iteration 2: data at [0, 1, 0] => "2" Iteration 3: data at [1, 1, 0]
// => "5" We got [2,5] Iteration 4: data at [0, 2, 0] => "3" Iteration 5: data at [1, 2, 0] => "6" We
// got [3,6]
const newShape = [1, shape[0], 1];
for (let i = 0; i < $axis; i++) {
 newShape[0] *= shape[i];
}
newShape[1] = shape[$axis];
for (let i = $axis + 1; i < shape.length; i++) {
 newShape[2] *= shape[i];
}
// A map from unique elements (their string representations) to their values in "indices" (below).
const uniqueElements: {[key: string]: number} = {};
// The indices of each unique element in the original tensor along
// the given axis. It is 1D and has the same size as the given axis.
const indices = new Int32Array(shape[$axis]);
// Create a buffer so we can easily extract value at a given location.
const inputBuffer = new TensorBuffer(newShape, dtype, values as
TypedArray);
// The indices along the given axis that have unique elements. This is a de-duped version of
"indices" above.
const uniqueIndices: number[] = [];
const is1DTensor = newShape[0] === 1 &&
newShape[2] === 1;
for (let i = 0; i < shape[$axis]; i++) {
 // Extract values along the axis.
 let element:
string;
 if (is1DTensor) {
 // Fast path for 1D tensor input.
 element = values[i].toString();
 } else {
 const axisValues = [];
 for (let m = 0; m < newShape[0]; m++) {
 for (let n = 0; n < newShape[2]; n++) {
 axisValues.push(inputBuffer.get(m, i, n));
 }
 element = axisValues.join(',');
 }
 // Dedup and update various indices.
 if (uniqueElements[element] !== undefined) {
 indices[i] =
uniqueElements[element];
 } else {
 const uniqueIndex = Object.keys(uniqueElements).length;
 uniqueElements[element] = uniqueIndex;
 indices[i] = uniqueIndex;
 }
 }
}
// Now we know where each of the unique elements are located along the
// axis (uniqueIndices). Extract them from input buffer and store them in the
// output buffer.
const outputTmpShape = newShape.slice();
outputTmpShape[1] = Object.keys(uniqueElements).length;
const outputBuffer = new TensorBuffer(outputTmpShape, dtype);
uniqueIndices.forEach((uniqueElementIndex, i) => {
 for (let m = 0; m < newShape[0]; m++) {
 for (let n = 0; n < newShape[2]; n++) {
 outputBuffer.set(inputBuffer.get(m, uniqueElementIndex, n), m, i, n);
 }
 }
});
// The output shape can
// be calculated from the input shape with the size of the given axis replaced by the number of unique elements
// along that axis.
const outputShape = shape.slice();
outputShape[$axis] = outputTmpShape[1];
return {
 outputValues: outputBuffer.values as BackendValues,
 outputShape,
 indices,
};
}
}
}

```

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```
=====
// Shared functionality among backends.
export { simpleAbsImpl } from './kernels/Abs';
export { addImpl }
from './kernels/Add';
export { bincountImpl, bincountReduceImpl } from './kernels/Bincount_impl';
export
{ ceilImpl } from './kernels/Ceil';
export { concatImpl } from './kernels/Concat_impl';
export
{ expImpl } from './kernels/Exp';
export { expm1Impl } from './kernels/Expm1';
export { floorImpl } from
'./kernels/Floor';
export { gatherV2Impl } from './kernels/GatherV2_impl';
export { greaterImpl } from

```



```

./kernels/Greater';\nextport {lessImpl} from './kernels/Less';\nextport {linSpaceImpl} from
./kernels/LinSpace_impl';\nextport {logImpl} from './kernels/Log';\nextport {maxImpl} from
./kernels/Max_impl';\nextport {maximumImpl} from './kernels/Maximum';\nextport {minimumImpl} from
./kernels/Minimum';\nextport {multiplyImpl} from './kernels/Multiply';\nextport {negImpl} from
./kernels/Neg';\nextport {notEqualImpl} from './kernels/NotEqual';\nextport {prodImpl} from
./kernels/Prod';\nextport {rangeImpl} from './kernels/Range_impl';\nextport {rsqrtImpl} from
./kernels/Rsqrt';\nextport {sliceImpl} from './kernels/Slice';\nextport {squaredDifferenceImpl} from
./kernels/SquaredDifference';\nextport {stridedSliceImpl} from './kernels/StridedSlice_impl';\nextport {subImpl}
from './kernels/Sub';\nextport
{tileImpl} from './kernels/Tile_impl';\nextport {topKImpl} from './kernels/TopK_impl';\nextport {transposeImpl}
from './kernels/Transpose_impl';\nextport {uniqueImpl} from './kernels/Unique_impl';\nextport
{ComplexBinaryKernelImpl, SimpleBinaryKernelImpl} from './utils/binary_types';\n", "\n/**\n * @license\n *
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\n// Import shared functionality from tfjs-backend-cpu without triggering\n// side effects.\n\n// tslint:disable-next-
line: no-imports-from-dist\nimport * as shared from '@tensorflow/tfjs-backend-cpu/dist/shared';\n\n// tslint:disable-
next-line: no-imports-from-dist\nimport {SimpleBinaryKernelImpl} from '@tensorflow/tfjs-backend-
cpu/dist/shared';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {SimpleUnaryImpl} from
'@tensorflow/tfjs-backend-cpu/dist/utils/unary_types';\n\nexport type SimpleBinaryKernelImplCPU =
SimpleBinaryKernelImpl;\nextport type SimpleUnaryKernelImplCPU = SimpleUnaryImpl;\nconst {\n addImpl:
addImplCPU,\n bincountImpl: bincountImplCPU,\n bincountReduceImpl: bincountReduceImplCPU,\n ceilImpl:
ceilImplCPU,\n concatImpl: concatImplCPU,\n expImpl: expImplCPU,\n expm1Impl: expm1ImplCPU,\n
floorImpl: floorImplCPU,\n gatherV2Impl: gatherV2ImplCPU,\n greaterImpl: greaterImplCPU,\n lessImpl:
lessImplCPU,\n linSpaceImpl: linSpaceImplCPU,\n
logImpl: logImplCPU,\n maxImpl: maxImplCPU,\n maximumImpl: maximumImplCPU,\n minimumImpl:
minimumImplCPU,\n multiplyImpl: multiplyImplCPU,\n negImpl: negImplCPU,\n prodImpl: prodImplCPU,\n
rangeImpl: rangeImplCPU,\n rsqrtImpl: rsqrtImplCPU,\n simpleAbsImpl: simpleAbsImplCPU,\n sliceImpl:
sliceImplCPU,\n stridedSliceImpl: stridedSliceImplCPU,\n subImpl: subImplCPU,\n tileImpl: tileImplCPU,\n
topKImpl: topKImplCPU,\n transposeImpl: transposeImplCPU,\n uniqueImpl: uniqueImplCPU,\n } =
shared;\n\nexport {\n addImplCPU,\n bincountImplCPU,\n bincountReduceImplCPU,\n ceilImplCPU,\n
concatImplCPU,\n expImplCPU,\n expm1ImplCPU,\n floorImplCPU,\n gatherV2ImplCPU,\n
greaterImplCPU,\n lessImplCPU,\n linSpaceImplCPU,\n logImplCPU,\n maxImplCPU,\n maximumImplCPU,\n
minimumImplCPU,\n multiplyImplCPU,\n negImplCPU,\n prodImplCPU,\n simpleAbsImplCPU,\n
sliceImplCPU,\n stridedSliceImplCPU,\n subImplCPU,\n rangeImplCPU,\n rsqrtImplCPU,\n tileImplCPU,\n
topKImplCPU,\n transposeImplCPU,\n uniqueImplCPU,\n };\n", "\n/**\n * @license\n * Copyright 2018 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nexport function getVecChannels(name: string, rank: number): string[] {\n return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0,

```

```

rank).map(d => `${name}.${d}`);\n\n\nexport function getChannels(name: string, rank: number):
string[] {\n if (rank === 1) {\n return [name];\n }\n return getVecChannels(name, rank);\n}\n\n\nexport function
getSourceCoords(rank: number, dims: string[]): string {\n if (rank === 1) {\n return 'rc';\n }\n\n let coords = ";\n
for (let i = 0; i < rank; i++) {\n coords += dims[i];\n if (i < rank - 1) {\n coords += ',';\n }\n }\n return
coords;\n}"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport
{getCoordsDataType} from './shader_compiler';\n\nexport class PackProgram implements GPGPUProgram {\n
variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs = false;\n packedOutput =
true;\n\n constructor(\n outputShape: number[]\n) {\n //
TODO(https://github.com/tensorflow/tfjs/issues/893):\n // Only input / output 3D tensors.\n
this.outputShape = outputShape;\n const rank = outputShape.length;\n\n if (rank === 0) {\n this.userCode =
`\n void main() {\n setOutput(vec4(getA(), 0., 0., 0.));\n }\n `;\n } else {\n const channels =
getChannels('rc', rank);\n const dtype = getCoordsDataType(rank);\n const outOfBoundsCondition =\n
getOutOfBoundsCondition(rank,\n outputShape, channels);\n const setup = getSetup(\n rank, outputShape[outputShape.length - 1],\n
outputShape[outputShape.length - 2], channels);\n const output = getOutput(outputShape, channels);\n\n
this.userCode = `\n void main() {\n ${dtype} rc = getOutputCoords();\n\n
if(${outOfBoundsCondition}) {\n setOutput(vec4(0));\n } else {\n ${setup}\n\n
setOutput(vec4(${output}));\n }\n }\n `;\n }\n }\n\n\nfunction getSourceCoordsArr(rank: number,
dims: string[]): string[] {\n const coords = [];\n\n for (let row = 0; row <= 1; row++) {\n for (let col = 0; col <= 1;
col++) {\n let coord = `${row === 0 ? 'r' : 'rp1'}`, ${col === 0 ? 'c' : 'cp1'} `;\n\n for (let d = 2; d < rank; d++)
{\n coord = `${dims[dims.length - 1 - d]},` + coord;\n }\n\n coords.push(coord);\n }\n }\n\n return
coords;\n}\n\n\nfunction getOutOfBoundsCondition(\n
rank: number, shape: number[], dims: string[]): string {\n if (rank === 1) {\n return `rc > ${shape[0]} `;\n }\n\n
let cond = ";\n for (let i = rank - 2; i < rank; i++) {\n cond += `${dims[i]} >= ${shape[i]} `;\n if (i < rank - 1) {\n
cond += '|';\n }\n }\n\n return cond;\n}\n\n\nfunction getSetup(\n rank: number, cols: number, rows: number,
dims: string[]): string {\n if (rank === 1) {\n return ";\n }\n\n const innerDims = dims.slice(-2);\n\n return `\n
int r = ${innerDims[0]};\n int c = ${innerDims[1]};\n int rp1 = r + 1;\n int cp1 = c + 1;\n\n bool cEdge = cp1
>= ${cols};\n bool rEdge = rp1 >= ${rows};\n `;\n }\n\n\nfunction getOutput(shape: number[], dims: string[]):
string {\n const rank = shape.length;\n const sourceCoords = getSourceCoordsArr(rank, dims);\n if (rank === 1)
{\n return `getA(rc),\n rc + 1 >= ${shape[0]} ? 0 : getA(rc + 1),\n 0, 0 `;\n }\n\n return
`getA(${sourceCoords[0]}),\n
cEdge ? 0 : getA(${sourceCoords[1]}),\n rEdge ? 0 : getA(${sourceCoords[2]}),\n rEdge || cEdge ?
0 : getA(${sourceCoords[3]}) `;\n }\n}"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
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=====

```

```

*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from
'./shader_compiler_util';\n\nexport class
ReshapePackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n constructor(outputShape: [number,
number, number], inputShape: [number, number, number]\n) {\n this.outputShape = outputShape;\n\n let
mainLoop = ``;\n for (let i = 0; i < 4; i++) {\n let thisRC = `thisRC = rc;`; \n if (i % 2 === 1) {\n thisRC
+= `thisRC.z += 1;`; \n } \n if (i > 1) {\n thisRC += `thisRC.y += 1;`; \n } \n mainLoop += `\n
${thisRC}\n ${i > 0 ? `if(thisRC.y < rows && thisRC.z < cols){` : ``}` \n int flatIndex =
getFlatIndex(thisRC);\n ivec3 inputRC = inputCoordsFromReshapedOutCoords(flatIndex);\n vec2
inputRCInnerDims = vec2(float(inputRC.y),float(inputRC.z));\n result[${i}] =\ngetChannel(getA(inputRC.x, inputRC.y, inputRC.z), inputRCInnerDims);\n ${i > 0 ? `}` : ``}\n
`;\n }\n\n this.userCode = `\n ${getReshapedInputCoords(inputShape)}\n
${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 rc = getOutputCoords();\n\n
vec4 result = vec4(0.);\n ivec3 thisRC;\n int rows = ${outputShape[1]};\n int cols =
${outputShape[2]};\n\n ${mainLoop}\n\n setOutput(result);\n }\n `;\n}\n\nfunction
getReshapedInputCoords(shape: [number, number, number]): string {\n const coordsFromIndexSnippet =\nshader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);\n\n return `\n ivec3
inputCoordsFromReshapedOutCoords(int index) {\n ${coordsFromIndexSnippet}\n return ivec3(r, c, d);\n
}\n `;\n}\n\n/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
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the specific language governing permissions and\n * limitations under the License.\n *
\n\n
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nimport {GPGPUContext} from './gpgpu_context';\nimport
{getInternalFormatForFloat16MatrixTexture, getInternalFormatForFloat16PackedMatrixTexture,
getInternalFormatForFloat32MatrixTexture, getInternalFormatForPackedMatrixTexture,
getInternalFormatForUnsignedBytesMatrixTexture} from './gpgpu_util';\nimport
{getPackedMatrixTextureShapeWidthHeight, getUnpackedMatrixTextureShapeWidthHeight, PhysicalTextureType,
TextureConfig, TextureUsage} from './tex_util';\n\nexport class
TextureManager {\n private numUsedTextures = 0;\n private numFreeTextures = 0;\n private
_numBytesAllocated = 0;\n private _numBytesFree = 0; // How many bytes that have been allocated\n
// are available for reuse.\n private freeTextures: {[shape: string]: WebGLTexture[]} = {};\n private
logEnabled = false;\n private usedTextures: {[shape: string]: WebGLTexture[]} = {};\n\n constructor(private
gpgpu: GPGPUContext) {\n\n acquireTexture(\n shapeRC: [number, number], usage: TextureUsage,\n
isPacked: boolean): WebGLTexture {\n const physicalTexType = getPhysicalFromLogicalTextureType(usage,
isPacked);\n\n const shapeKey = getKeyFromTextureShape(shapeRC, physicalTexType, isPacked);\n if
(!shapeKey in this.freeTextures) {\n this.freeTextures[shapeKey] = [];\n }\n if (!shapeKey in
this.usedTextures) {\n this.usedTextures[shapeKey] = [];\n }\n\n const texBytes = computeBytes(\n
shapeRC, physicalTexType,
this.gpgpu.gl, this.gpgpu.textureConfig,\n isPacked);\n\n if (this.freeTextures[shapeKey].length > 0) {\n
this.numFreeTextures--;\n this.numUsedTextures++;\n this._numBytesFree -= texBytes;\n this.log();\n
const newTexture = this.freeTextures[shapeKey].shift();\n this.usedTextures[shapeKey].push(newTexture);\n
return newTexture;\n }\n\n let newTexture: WebGLTexture;\n if (physicalTexType ===
PhysicalTextureType.PACKED_2X2_FLOAT32) {\n newTexture =
this.gpgpu.createPackedMatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===

```

```

PhysicalTextureType.PACKED_2X2_FLOAT16) {\n newTexture =\n
this.gpgpu.createFloat16PackedMatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===
PhysicalTextureType.UNPACKED_FLOAT32) {\n newTexture =\n
this.gpgpu.createFloat32MatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===
PhysicalTextureType.UNPACKED_FLOAT16) {\n
 newTexture =\n this.gpgpu.createFloat16MatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (\n
physicalTexType === PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE) {\n newTexture =\n
this.gpgpu.createUnsignedBytesMatrixTexture(shapeRC[0], shapeRC[1]);\n }\n
this.usedTextures[shapeKey].push(newTexture);\n\n this.numUsedTextures++;\n this._numBytesAllocated +=
texBytes;\n this.log();\n\n return newTexture;\n }\n\n releaseTexture(\n texture: WebGLTexture, shape:
[number, number],\n logicalTexType: TextureUsage, isPacked: boolean): void {\n if (this.freeTextures == null)
{\n // Already disposed.\n return;\n }\n const physicalTexType =\n
getPhysicalFromLogicalTextureType(logicalTexType, isPacked);\n const shapeKey =
getKeyFromTextureShape(shape, physicalTexType, isPacked);\n if (!(shapeKey in this.freeTextures)) {\n
this.freeTextures[shapeKey] = [];\n }\n\n const texBytes = computeBytes(\n
 shape, physicalTexType, this.gpgpu.gl, this.gpgpu.textureConfig,\n isPacked);\n const
deleteTexThreshold = env().get('WEBGL_DELETE_TEXTURE_THRESHOLD');\n if (deleteTexThreshold !== -
1 &&\n this._numBytesAllocated > deleteTexThreshold) {\n this.gpgpu.deleteMatrixTexture(texture);\n
this._numBytesAllocated -= texBytes;\n } else {\n this.freeTextures[shapeKey].push(texture);\n
this.numFreeTextures++;\n this._numBytesFree += texBytes;\n }\n\n this.numUsedTextures--;\n\n const
texList = this.usedTextures[shapeKey];\n const texIndex = texList.indexOf(texture);\n if (texIndex < 0) {\n
throw new Error(\n 'Cannot release a texture that was never provided by this ' +\n 'texture manager');\n
}\n texList.splice(texIndex, 1);\n this.log();\n }\n\n private log() {\n if (!this.logEnabled) {\n return;\n
}\n const total = this.numFreeTextures + this.numUsedTextures;\n console.log(\n
 'Free/Used', `${this.numFreeTextures} / ${this.numUsedTextures}`,\n `(${total})`);\n const freeRatio =
this._numBytesFree / this._numBytesAllocated;\n console.log(`Bytes allocated: ${this._numBytesAllocated}`);\n
console.log(`Bytes unused: ${this._numBytesFree} (${Math.round(100 * freeRatio)}%)`);\n }\n\n get
numBytesAllocated(): number {\n return this._numBytesAllocated;\n }\n\n get numBytesFree(): number {\n
return this._numBytesFree;\n }\n\n getNumUsedTextures(): number {\n return this.numUsedTextures;\n }\n\n
getNumFreeTextures(): number {\n return this.numFreeTextures;\n }\n\n dispose() {\n if (this.freeTextures ==
null) {\n // Already disposed.\n return;\n }\n for (const texShape in this.freeTextures) {\n
this.freeTextures[texShape].forEach(tex => {\n this.gpgpu.deleteMatrixTexture(tex);\n });\n }\n for
(const texShape in this.usedTextures) {\n this.usedTextures[texShape].forEach(tex
=> {\n this.gpgpu.deleteMatrixTexture(tex);\n });\n }\n this.freeTextures = null;\n this.usedTextures =
null;\n this.numUsedTextures = 0;\n this.numFreeTextures = 0;\n this._numBytesAllocated = 0;\n
this._numBytesFree = 0;\n }\n\nfunction numBytesForInternalFormat(\n gl: WebGLRenderingContext,
internalFormat: number): number {\n // tslint:disable-next-line:no-any\n const glany = gl as any;\n if
(internalFormat === glany.R32F) {\n return 4;\n } else if (internalFormat === glany.R16F) {\n return 2;\n }
else if (internalFormat === glany.RGBA32F) {\n return 16;\n } else if (internalFormat === gl.RGBA) {\n
return 16;\n } else if (internalFormat === glany.RGBA16F) {\n return 8;\n }\n throw new Error(`Unknown
internal format ${internalFormat}`);\n }\n\nexport function computeBytes(\n shape: [number, number],
physicalTexType: PhysicalTextureType,\n gl: WebGLRenderingContext, textureConfig: TextureConfig,\n
isPacked:
boolean): number {\n // It is not possible to infer packed status from the texture type because\n // depending on the
textureConfig, different texture types may resolve to the\n // same internal format (e.g. in WebGL1, the internal
format for\n // UNPACKED_FLOAT16 textures is gl.RGBA). Therefore we pass in `isPacked`\n // explicitly.\n const internalFormat =\n internalFormatForPhysicalTexType(physicalTexType, textureConfig);\n let
numElements: number;\n if (isPacked) {\n const [packedWidth, packedHeight] =\n

```

```

getPackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n numElements = packedWidth *
packedHeight;\n\n } else {\n const [width, height] =\ngetUnpackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n numElements = width * height;\n }\n\nconst bytesPerElement = numBytesForInternalFormat(gl, internalFormat);\n return numElements *
bytesPerElement;\n}\n\nfunction internalFormatForPhysicalTexType(\n physicalTexType:
PhysicalTextureType,\n textureConfig: TextureConfig): number {\n switch (physicalTexType) {\n case
PhysicalTextureType.PACKED_2X2_FLOAT32:\n return
getInternalFormatForPackedMatrixTexture(textureConfig);\n case
PhysicalTextureType.PACKED_2X2_FLOAT16:\n return
getInternalFormatForFloat16PackedMatrixTexture(textureConfig);\n case
PhysicalTextureType.UNPACKED_FLOAT32:\n return
getInternalFormatForFloat32MatrixTexture(textureConfig);\n case
PhysicalTextureType.UNPACKED_FLOAT16:\n return
getInternalFormatForFloat16MatrixTexture(textureConfig);\n case
PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE:\n return
getInternalFormatForUnsignedBytesMatrixTexture(textureConfig);\n default:\n throw new Error(`Unknown
physical texture type ${physicalTexType}`);\n }\n}\n\nfunction getPhysicalTextureForRendering(isPacked:
boolean):\n PhysicalTextureType {\n if (env().getBool('WEBGL_RENDER_FLOAT32_ENABLED')) {\n if
(isPacked) {\n return PhysicalTextureType.PACKED_2X2_FLOAT32;\n
 }\n return PhysicalTextureType.UNPACKED_FLOAT32;\n }\n if (isPacked) {\n return
PhysicalTextureType.PACKED_2X2_FLOAT16;\n }\n return
PhysicalTextureType.UNPACKED_FLOAT16;\n }\n}\n\nfunction getPhysicalFromLogicalTextureType(\n
logicalTexType: TextureUsage, isPacked: boolean): PhysicalTextureType {\n if (logicalTexType ===
TextureUsage.UPLOAD) {\n return PhysicalTextureType.PACKED_2X2_FLOAT32;\n } else if (logicalTexType
=== TextureUsage.RENDER || logicalTexType == null) {\n return getPhysicalTextureForRendering(isPacked);\n
 } else if (\n logicalTexType === TextureUsage.DOWNLOAD ||\n logicalTexType ===
TextureUsage.PIXELS) {\n return PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE;\n }\n throw new
Error(`Unknown logical texture type ${logicalTexType}`);\n }\n}\n\nfunction getKeyFromTextureShape(\n
shapeRowsCol: [number, number], physicalTexType: PhysicalTextureType,\n isPacked: boolean): string {\n
return `${shapeRowsCol[0]}_${shapeRowsCol[1]}_${physicalTexType}_${isPacked}`;\n }\n /**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n =====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class UnaryOpProgram implements
GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(aShape: number[], opSnippet:
string) {\n this.outputShape = aShape;\n this.userCode =`\n float unaryOperation(float x) {\n
${opSnippet}\n }\n\n void main() {\n float x = getAAtOutCoords();\n float y =
unaryOperation(x);\n\n setOutput(y);\n }\n `;\n }\n}\n\nexport const CHECK_NAN_SNIPPET = `if
(isnan(x)) return x;`\n\nexport const LINEAR = `return x;`\n\nexport const ABS = `return abs(x);`\n\nexport
function STEP(alpha = 0.0) {\n return CHECK_NAN_SNIPPET +`\n return x > 0.0 ? 1.0 : float(${alpha});`\n
`;\n}\n\nexport const ELU = `return (x >= 0.0) ? x : (exp(x) - 1.0);`\n\nexport const RELU =
CHECK_NAN_SNIPPET +`\n return (x < 0.0) ? 0.0 : x;`\n}\n\nexport const RELU6 = CHECK_NAN_SNIPPET +

```

\n return (x < 0.0) ? 0.0 : min(6.0, x);\n`;\n\nexport const CLONE = 'return x;'\n", "/\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this

file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nexport const LINEAR = `return x;`\nexport const ELU = `\n vec4 result;\n result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);\n result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);\n result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);\n result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);\n return result;\n`;\nexport const RELU = `\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isNaN(x);\n result.r = isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a : result.a;\n return result;\n`;\nexport const RELU6 = `\n vec4 result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isNaN(x);\n result.r = isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a : result.a;\n return result;\n`;\nexport class UnaryOpPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = true;\n packedOutput = true;\n constructor(aShape: number[], opSnippet: string) {\n this.outputShape = aShape;\n this.userCode =`\n vec4 unaryOperation(vec4 x) {\n ${opSnippet}\n }\n void main() {\n vec4 x =\n getAAAtOutCoords();\n vec4 y = unaryOperation(x);\n setOutput(y);\n }\n `;\n }\n}
```

setOutput(y);\n }\n}\n", "/\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels, getSourceCoords} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\nexport class UnpackProgram implements GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = false;\n outputShape: number[];\n userCode: string;\n constructor(outputShape: number[]) {\n this.outputShape = outputShape;\n const rank = outputShape.length;\n const channels = getChannels('rc', rank);\n const dtype = getCoordsDataType(rank);\n const sourceCoords = getSourceCoords(rank, channels);\n const innerDims = channels.slice(-2);\n const coords = rank <= 1 ? 'rc' : `vec2(${innerDims.join(',')}`;\n this.userCode = `\n void main() {\n ${dtype} rc = getOutputCoords();\n vec4 packedInput = getA(${sourceCoords});\n setOutput(getChannel(packedInput, ${coords}));\n }\n `;\n }\n}\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\n// Import WebGL flags.\nimport './flags_webgl';\nimport * as tf from '@tensorflow/tfjs-core';\nimport
```

```

{backend_util, BackendValues, buffer, DataId, DataStorage, DataType, DataValues, engine, env, kernel_impls,
KernelBackend, MemoryInfo, NumericDataType, Rank, RecursiveArray, scalar, ShapeMap, Tensor, Tensor2D,
TensorBuffer, TensorInfo, tidy, TimingInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport
{getWebGLContext} from './canvas_util';\nimport {DecodeMatrixProgram} from './decode_matrix_gpu';\nimport
{DecodeMatrixPackedProgram} from './decode_matrix_packed_gpu';\nimport
{EncodeFloatProgram} from './encode_float_gpu';\nimport {EncodeFloatPackedProgram} from
'./encode_float_packed_gpu';\nimport {EncodeMatrixProgram} from './encode_matrix_gpu';\nimport
{EncodeMatrixPackedProgram} from './encode_matrix_packed_gpu';\nimport {GPGPUContext} from
'./gpgpu_context';\nimport * as gpgpu_math from './gpgpu_math';\nimport {GPGPUBinary, GPGPUProgram,
TensorData} from './gpgpu_math';\nimport {simpleAbsImplCPU} from './kernel_utils/shared';\nimport
{PackProgram} from './pack_gpu';\nimport {ReshapePackedProgram} from './reshape_packed_gpu';\nimport * as
tex_util from './tex_util';\nimport {TextureData, TextureUsage} from './tex_util';\nimport {TextureManager} from
'./texture_manager';\nimport * as unary_op from './unaryop_gpu';\nimport {UnaryOpProgram} from
'./unaryop_gpu';\nimport {UnaryOpPackedProgram} from './unaryop_packed_gpu';\nimport {UnpackProgram} from
'./unpack_gpu';\nimport * as webgl_util from './webgl_util';\n\nconst whereImpl
= kernel_impls.whereImpl;\n\nexport const EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 =
1e-4;\n\ninterface KernelInfo = {\n name: string;\n query: Promise<number>;\n};\n\nexport type TimerNode =
RecursiveArray<KernelInfo>|KernelInfo;\n\nexport interface CPUScheduler {\n startMs: number;\n endMs?:
number;\n}\n\nexport interface WebGLMemoryInfo extends MemoryInfo {\n numBytesInGPU: number;\n //
Tracks the total number of bytes allocated on the GPU, accounting for the\n // physical texture type.\n numBytesInGPUAllocated: number;\n // Tracks byte size of textures that were created and then made available
for\n // reuse (disposed).\n numBytesInGPUFree: number;\n unreliable: boolean;\n}\n\nexport interface
WebGLTimingInfo extends TimingInfo {\n uploadWaitMs: number;\n downloadWaitMs: number;\n}\n\nconst
binaryCaches: {[webGLVersion: string]: {[key: string]: GPGPUBinary}} = {};\n\nexport function
getBinaryCache(webGLVersion: number) {\n if (webGLVersion in binaryCaches)
{\n return binaryCaches[webGLVersion];\n }\n binaryCaches[webGLVersion] = {};\n return
binaryCaches[webGLVersion];\n}\n\n// Empirically determined constant used to determine size threshold for
handling\n// off execution to the CPU.\nconst CPU_HANDOFF_SIZE_THRESHOLD = 128;\n\n// Empirically
determined constant used to decide the number of MB on GPU\n// before we warn about high memory use. The MB
are this constant * screen area\n// * dpi / 1024 / 1024.\nconst BEFORE_PAGING_CONSTANT = 600;\n\nfunction
numMBBeforeWarning(): number {\n if (env().global.screen == null) {\n return 1024; // 1 GB.\n }\n return
(env().global.screen.height * env().global.screen.width * \n window.devicePixelRatio) * \n BEFORE_PAGING_CONSTANT / 1024 / 1024;\n}\n\nexport class MathBackendWebGL extends KernelBackend
{\n texData: DataStorage<TextureData>;\n gpgpu: GPGPUContext;\n\n private static nextDataId = 0;\n private
nextDataId(): number {\n return MathBackendWebGL.nextDataId++;\n }\n\n // Maps data ids that have a pending read operation, to list of subscribers.\n private pendingRead = new
WeakMap<DataId, Array<(arr: TypedArray) => void>>;\n // List of data ids that are scheduled for disposal, but
are waiting on a\n // pending read operation.\n private pendingDisposal = new WeakSet<DataId>;\n\n // Used to
count the number of 'shallow' sliced tensors that point to the\n // same data id.\n dataRefCount = new
WeakMap<DataId, number>;\n private numBytesInGPU = 0;\n\n private canvas:
HTMLCanvasElement|OffscreenCanvas;\n\n private programTimersStack: TimerNode[];\n private activeTimers:
TimerNode[];\n // Accumulated time spent (including blocking) in uploading data to webgl.\n private
uploadWaitMs = 0;\n // Accumulated time spent (including blocking in downloading data from webgl.\n private
downloadWaitMs = 0;\n private cpuBackend: KernelBackend;\n\n // Number of bits of precision of this backend.\n private floatPrecisionValue: 32|16;\n\n private
textureManager: TextureManager;\n private binaryCache: {[key: string]: GPGPUBinary};\n private
gpgpuCreatedLocally: boolean;\n private numMBBeforeWarning: number;\n private warnedAboutMemory =
false;\n private warnedAboutCPUBackend = false;\n\n constructor(gpgpu?: GPGPUContext) {\n super();\n if

```

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(!env().getBool('HAS_WEBGL')) {\n throw new Error('WebGL is not supported on this device');\n }\n\n if
(gpgpu == null) {\n const gl = getWebGLContext(env().getNumber('WEBGL_VERSION'));\n
this.binaryCache = getBinaryCache(env().getNumber('WEBGL_VERSION'));\n this.gpgpu = new
GPGPUContext(gl);\n this.canvas = gl.canvas;\n this.gpgpuCreatedLocally = true;\n } else {\n this.gpgpu
= gpgpu;\n this.binaryCache = {};\n this.gpgpuCreatedLocally = false;\n this.canvas = gpgpu.gl.canvas;\n
 }\n this.textureManager = new TextureManager(this.gpgpu);\n this.numMBBeforeWarning =
numMBBeforeWarning();\n\n this.texData = new DataStorage(this,
engine());\n }\n\n numDataIds() {\n return this.texData.numDataIds() +\n (this.cpuBackend ?
this.cpuBackend.numDataIds() : 0) -\n this.pendingDeletes;\n }\n\n write(values: BackendValues, shape:
number[], dtype: DataType): DataId {\n if (env().getBool('WEBGL_CHECK_NUMERICAL_PROBLEMS') ||\n
env().getBool('DEBUG')) {\n this.checkNumericalProblems(values);\n }\n if (dtype === 'complex64' &&
values != null) {\n throw new Error(\n `Cannot write to a complex64 dtype. ` +\n `Please use
tf.complex(real, imag).`);\n }\n const dataId = {id: this.nextDataId()};\n this.texData.set(\n
dataId,\n {shape, dtype, values, usage: TextureUsage.UPLOAD, refCount: 1});\n return dataId;\n }\n\n /** Return
refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.texData.has(dataId)) {\n const
tensorData = this.texData.get(dataId);\n return tensorData.refCount;\n }\n
return 0;\n }\n\n /** Increase refCount of a `TextureData`. */\n incRef(dataId: DataId): void {\n const texData
= this.texData.get(dataId);\n texData.refCount++;\n }\n\n /** Decrease refCount of a `TextureData`. */\n
decRef(dataId: DataId): void {\n if (this.texData.has(dataId)) {\n const texData = this.texData.get(dataId);\n
texData.refCount--;\n }\n }\n\n move(\n dataId: DataId, values: BackendValues, shape: number[], dtype:
DataType,\n refCount: number): void {\n if (env().getBool('DEBUG')) {\n
this.checkNumericalProblems(values);\n }\n if (dtype === 'complex64') {\n throw new Error(\n `Cannot
write to a complex64 dtype. ` +\n `Please use tf.complex(real, imag).`);\n }\n this.texData.set(\n
dataId, {shape, dtype, values, usage: TextureUsage.UPLOAD, refCount});\n }\n\n disposeIntermediateTensorInfo(tensorInfo: TensorInfo): void {\n
this.disposeData(tensorInfo.dataId);\n }\n\n readSync(dataId:
DataId): BackendValues {\n const texData = this.texData.get(dataId);\n const {values, dtype,
complexTensorInfos, slice, shape, isPacked} = texData;\n\n // The presence of `slice` indicates this tensor is a
shallow slice of a\n // different tensor, and is using that original tensor's texture. Run\n // `clone` in order to copy
that texture and read from it.\n if (slice != null) {\n let program;\n if (isPacked) {\n program = new
UnaryOpPackedProgram(shape, unary_op.CLONE);\n } else {\n program = new UnaryOpProgram(shape,
unary_op.CLONE);\n }\n const res =\n this.runWebGLProgram(program, [{dataId, shape, dtype}],
dtype);\n const data = this.readSync(res.dataId);\n this.disposeIntermediateTensorInfo(res);\n return data;\n
 }\n if (values != null) {\n return this.convertAndCacheOnCPU(dataId);\n }\n if (dtype === 'string') {\n
return values;\n }\n const shouldTimeProgram = this.activeTimers
!= null;\n let start: number;\n if (shouldTimeProgram) {\n start = util.now();\n }\n\n let result:
Float32Array;\n if (dtype === 'complex64') {\n const realValues =\n
this.readSync(complexTensorInfos.real.dataId) as Float32Array;\n const imagValues =\n
this.readSync(complexTensorInfos.imag.dataId) as Float32Array;\n result =
backend_util.mergeRealAndImagArrays(realValues, imagValues);\n } else {\n result =
this.getValuesFromTexture(dataId);\n }\n\n if (shouldTimeProgram) {\n this.downloadWaitMs += util.now()
- start;\n }\n return this.convertAndCacheOnCPU(dataId, result);\n }\n\n async read(dataId: DataId):
Promise<BackendValues> {\n if (this.pendingRead.has(dataId)) {\n const subscribers =
this.pendingRead.get(dataId);\n return new Promise<TypedArray>(resolve => subscribers.push(resolve));\n }\n
const texData = this.texData.get(dataId);\n const {values, shape, slice, dtype,
complexTensorInfos, isPacked} = texData;\n\n // The presence of `slice` indicates this tensor is a shallow slice of
a\n // different tensor, and is using that original tensor's texture. Run\n // `clone` in order to copy that texture and
read from it.\n if (slice != null) {\n let program;\n if (isPacked) {\n program = new

```



```

UnaryOpPackedProgram(shape, unary_op.CLONE);\n } else {\n program = new UnaryOpProgram(shape,
unary_op.CLONE);\n }\n const res =\n this.runWebGLProgram(program, [{dataId, shape, dtype}],
dtype);\n const data = this.read(res.dataId);\n this.disposeIntermediateTensorInfo(res);\n return data;\n}\n\nif (values != null) {\n return this.convertAndCacheOnCPU(dataId);\n}\n\nif
(!env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED') &&\n
env().getNumber('WEBGL_VERSION') === 2) {\n throw new Error(\n `tensor.data() with
WEBGL_DOWNLOAD_FLOAT_ENABLED=false and ` +\n
 `WEBGL_VERSION=2 not yet supported.`);\n}\n\nlet buffer = null;\nlet tmpDownloadTarget:
TensorInfo;\n\nif (dtype !== 'complex64' && env().get('WEBGL_BUFFER_SUPPORTED')) {\n // Possibly
copy the texture into a buffer before inserting a fence.\n tmpDownloadTarget = this.decode(dataId);\n const
tmpData = this.texData.get(tmpDownloadTarget.dataId);\n buffer = this.gpgpu.createBufferFromTexture(\n
 tmpData.texture, ...tex_util.getDenseTexShape(shape));\n}\n\nthis.pendingRead.set(dataId, []);\n\nif (dtype
!== 'complex64') {\n // Create a fence and wait for it to resolve.\n await
this.gpgpu.createAndWaitForFence();\n}\n\n// Download the values from the GPU.\nlet vals:
Float32Array;\n\nif (dtype === 'complex64') {\n const ps = await Promise.all([\n
 this.read(complexTensorInfos.real.dataId),\n this.read(complexTensorInfos.imag.dataId)\n]);\n const
realValues = ps[0];\n const
imagValues = ps[1];\n vals = backend_util.mergeRealAndImagArrays(\n realValues as Float32Array,
imagValues as Float32Array);\n } else if (buffer === null) {\n vals = this.getValuesFromTexture(dataId);\n }
else {\n const size = util.sizeFromShape(shape);\n vals =
this.gpgpu.downloadFloat32MatrixFromBuffer(buffer, size);\n }\n\nif (tmpDownloadTarget != null) {\n
 this.disposeIntermediateTensorInfo(tmpDownloadTarget);\n}\n\nconst dTypeVals =
this.convertAndCacheOnCPU(dataId, vals);\n\nconst subscribers = this.pendingRead.get(dataId);\n
this.pendingRead.delete(dataId);\n\n// Notify all pending reads.\nsubscribers.forEach(resolve =>
resolve(dTypeVals));\n\nif (this.pendingDisposal.has(dataId)) {\n this.pendingDisposal.delete(dataId);\n}\n\nif
(this.disposeData(dataId)) {\n engine().removeDataId(dataId, this);\n}\n\nthis.pendingDeletes--;\n}\n\nreturn
dTypeVals;\n}\n\nbufferSync<R extends Rank>(t:
TensorInfo): TensorBuffer<R> {\n const data = this.readSync(t.dataId);\n let decodedData = data as
DataValues;\n if (t.dtype === 'string') {\n try {\n // Decode the bytes into string.\n decodedData = (data
as Uint8Array[]).map(d => util.decodeString(d));\n } catch {\n throw new Error('Failed to decode encoded
string bytes into utf-8');\n }\n }\n\nreturn buffer(t.shape as ShapeMap[R], t.dtype, decodedData) as\n
TensorBuffer<R>;\n}\n\nprivate checkNumericalProblems(values: BackendValues): void {\n if (values === null)\n return;\n for (let i = 0; i < values.length; i++) {\n const num = values[i] as number;\n if
(!webgl_util.canBeRepresented(num)) {\n if (env().getBool('WEBGL_RENDER_FLOAT32_CAPABLE')) {\n
 throw Error(\n `The value ${num} cannot be represented with your ` +\n
 `current settings. Consider enabling float32 rendering: ` +\n
 `tf.env().set('WEBGL_RENDER_FLOAT32_ENABLED',
true);`);\n }\n throw Error(`The value ${num} cannot be represented on this device.`);\n }\n }\n}\n\nprivate
getValuesFromTexture(dataId: DataId): Float32Array {\n const {shape, dtype, isPacked} =
this.texData.get(dataId);\n const size = util.sizeFromShape(shape);\n if
(env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED')) {\n const tmpTarget = this.decode(dataId);\n const
tmpData = this.texData.get(tmpTarget.dataId);\n const vals = this.gpgpu\n
 .downloadMatrixFromPackedTexture(\n tmpData.texture, ...tex_util.getDenseTexShape(shape))\n
 .subarray(0, size);\n this.disposeIntermediateTensorInfo(tmpTarget);\n return vals;\n }\n\nconst
shouldUsePackedProgram =\n env().getBool('WEBGL_PACK') && isPacked === true;\n const
outputShape =\n shouldUsePackedProgram ? webgl_util.getShapeAs3D(shape) : shape;\n const program = shouldUsePackedProgram ?\n new EncodeFloatPackedProgram(outputShape as [number,
number, number]) :\n new EncodeFloatProgram(outputShape);\n const output = this.runWebGLProgram(\n
 program, [{shape: outputShape, dtype, dataId}], 'float32');\n const tmpData = this.texData.get(output.dataId);\n

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const vals = \n this.gpgpu\n .downloadByteEncodedFloatMatrixFromOutputTexture(\n
tmpData.texture, tmpData.texShape[0], tmpData.texShape[1])\n .subarray(0, size);\n
this.disposeIntermediateTensorInfo(output);\n\n return vals;\n }\n\n timerAvailable(): boolean {\n return
env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0;\n }\n\n async time(f:
() => void): Promise<WebGLTimingInfo> {\n const oldActiveTimers = this.activeTimers;\n const
newActiveTimers: TimerNode[] = [];\n let outerMostTime = false;\n if (this.programTimersStack == null) {\n
this.programTimersStack
= newActiveTimers;\n outerMostTime = true;\n } else {\n this.activeTimers.push(newActiveTimers);\n
}\n this.activeTimers = newActiveTimers;\n\n f();\n\n // needing to split these up because util.flatten only
accepts certain types\n const flattenedActiveTimerQueries = \n util.flatten(this.activeTimers.map((d:
KernelInfo) => d.query))\n .filter(d => d != null);\n const flattenedActiveTimerNames = \n
util.flatten(this.activeTimers.map((d: KernelInfo) => d.name))\n .filter(d => d != null);\n\n
this.activeTimers = oldActiveTimers;\n\n if (outerMostTime) {\n this.programTimersStack = null;\n }\n\n
const res: WebGLTimingInfo = {\n uploadWaitMs: this.uploadWaitMs,\n downloadWaitMs:
this.downloadWaitMs,\n kernelMs: null,\n wallMs: null // will be filled by the engine\n }; \n\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n const kernelMs
= await Promise.all(flattenedActiveTimerQueries);\n\n
res['kernelMs'] = util.sum(kernelMs);\n res['getExtraProfileInfo'] = () =>\n kernelMs.map((d, i) =>
({name: flattenedActiveTimerNames[i], ms: d}))\n .map(d => `${d.name}: ${d.ms}`)\n .join(', '); \n
} else {\n res['kernelMs'] = {\n error: 'WebGL query timers are not supported in this environment.'\n }; \n
}\n\n this.uploadWaitMs = 0;\n this.downloadWaitMs = 0;\n return res;\n }\n\n memory():
WebGLMemoryInfo {\n return {\n unreliable: false,\n numBytesInGPU: this.numBytesInGPU,\n
numBytesInGPUAllocated: this.textureManager.numBytesAllocated,\n numBytesInGPUFree:
this.textureManager.numBytesFree\n } as WebGLMemoryInfo;\n }\n\n private startTimer():
WebGLQuery|CPUTimerQuery {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n return
this.gpgpu.beginQuery();\n }\n return {startMs: util.now(), endMs: null};\n
}\n\n private endTimer(query: WebGLQuery|CPUTimerQuery): WebGLQuery|CPUTimerQuery {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n
this.gpgpu.endQuery();\n return query;\n }\n (query as CPUTimerQuery).endMs = util.now();\n return
query;\n }\n\n private async getQueryTime(query: WebGLQuery|CPUTimerQuery): Promise<number> {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n return
this.gpgpu.waitForQueryAndGetTime(query as WebGLQuery);\n }\n const timerQuery = query as
CPUTimerQuery;\n return timerQuery.endMs - timerQuery.startMs;\n }\n\n private pendingDeletes = 0;\n\n
/**\n * Decrease the RefCount on the dataId and dispose the memory if the dataId\n * has 0 refCount. If there are
pending read on the data, the disposal would\n * added to the pending delete queue. Return true if the dataId is
removed\n * from backend or the backend does not contain the dataId, false if
the\n * dataId is not removed. Memory may or may not be released even when dataId\n * is removed, which also
depends on dataRefCount, see `releaseGPU`.\n * @param dataId\n * @oaram force Optional, remove the data
regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if
(this.pendingDisposal.has(dataId)) {\n return false;\n }\n\n // No-op if already disposed.\n if
(!this.texData.has(dataId)) {\n return true;\n }\n\n // if force flag is set, change refCount to 0, this would
ensure disposal\n // when added to the pendingDisposal queue. Memory may or may not be\n // released, which
also depends on dataRefCount, see `releaseGPU`.\n if (force) {\n this.texData.get(dataId).refCount = 0;\n }
else {\n this.texData.get(dataId).refCount--;\n }\n\n if (!force && this.texData.get(dataId).refCount > 0) {\n
return false;\n }\n\n if (this.pendingRead.has(dataId)) {\n this.pendingDisposal.add(dataId);\n
this.pendingDeletes++;\n return false;\n }\n\n this.releaseGPUData(dataId);\n const
{complexTensorInfos} = this.texData.get(dataId);\n if (complexTensorInfos != null) {\n

```

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this.disposeData(complexTensorInfos.real.dataId, force);\n this.disposeData(complexTensorInfos.imag.dataId,
force);\n }\n\n this.texData.delete(dataId);\n\n return true;\n }\n\n private releaseGPUData(dataId: DataId):
void {\n const {texture, dtype, texShape, usage, isPacked, slice} =\n this.texData.get(dataId);\n const key =
slice && slice.origDataId || dataId;\n const refCount = this.dataRefCount.get(key);\n\n if (refCount > 1) {\n
this.dataRefCount.set(key, refCount - 1);\n } else {\n this.dataRefCount.delete(key);\n if (texture != null) {\n
 this.numBytesInGPU -= this.computeBytes(texShape, dtype);\n this.textureManager.releaseTexture(texture,
texShape, usage, isPacked);\n }\n }\n\n const texData
= this.texData.get(dataId);\n texData.texture = null;\n texData.texShape = null;\n texData.isPacked = false;\n
texData.slice = null;\n }\n\n getTexture(dataId: DataId): WebGLTexture {\n this.uploadToGPU(dataId);\n
return this.texData.get(dataId).texture;\n }\n\n /**\n * Returns internal information for the specific data bucket.
Used in unit\n * tests.\n */\n getDataInfo(dataId: DataId): TextureData {\n return this.texData.get(dataId);\n
}\n\n private getCPUBackend(): KernelBackend|null {\n if (!env().getBool('WEBGL_CPU_FORWARD')) {\n
return null;\n }\n\n if (this.cpuBackend == null) {\n this.cpuBackend = engine().findBackend('cpu');\n }\n\n
return this.cpuBackend;\n }\n\n /**\n Tests whether all the inputs to an op are small and on the CPU. This
heuristic\n determines when it would be faster to execute a kernel on the CPU. WebGL\n kernels opt into running
this check and forwarding when appropriate.\n TODO(https://github.com/tensorflow/tfjs/issues/872):
Develop a more\n sustainable strategy for optimizing backend execution of ops.\n */\n shouldExecuteOnCPU(\n
inputs: TensorInfo[],\n sizeThreshold = CPU_HANDOFF_SIZE_THRESHOLD): boolean {\n const
cpuBackend = this.getCPUBackend();\n if (!env().getBool('IS_TEST') && !this.warnedAboutCPUBackend &&\n
cpuBackend == null) {\n console.warn(\n 'Your application contains ops that are small enough to be '
+\n 'executed on the CPU backend, however the CPU backend cannot ' +\n 'be found. Consider importing
the CPU backend ' +\n '@tensorflow/tfjs-backend-cpu for better performance.);\n this.warnedAboutCPUBackend = true;\n }\n\n return cpuBackend != null &&\n
inputs.every(\n input
=> this.texData.get(input.dataId).texture == null &&\n
util.sizeFromShape(input.shape) <
sizeThreshold);\n }\n\n getGPGPUContext(): GPGPUContext {\n return this.gpgpu;\n
}\n\n where(condition: Tensor): Tensor2D {\n backend_util.warn(\n 'tf.where() in webgl locks the UI thread.
'+\n 'Call tf.whereAsync() instead');\n const condVals = condition.dataSync();\n return
whereImpl(condition.shape, condVals);\n }\n\n private packedUnaryOp(x: TensorInfo, op: string, dtype:
DataType) {\n const program = new UnaryOpPackedProgram(x.shape, op);\n const outInfo =
this.compileAndRun(program, [x], dtype);\n return engine().makeTensorFromDataId(\n outInfo.dataId,
outInfo.shape, outInfo.dtype);\n }\n\n // TODO(msoulanille) remove this once the backend has been modularized\n
// a copy is needed here to break a circular dependency.\n // Also remove the op from unary_op.\n abs<T extends
Tensor>(x: T): T {\n // TODO: handle cases when x is complex.\n if (this.shouldExecuteOnCPU([x]) &&
x.dtype !== 'complex64') {\n const outValues =\n simpleAbsImplCPU(this.texData.get(x.dataId).values as
TypedArray);\n return this.makeOutput(x.shape, x.dtype, outValues);\n }\n\n if
(env().getBool('WEBGL_PACK_UNARY_OPERATIONS')) {\n return this.packedUnaryOp(x, unary_op.ABS,
x.dtype) as T;\n }\n\n const program = new UnaryOpProgram(x.shape, unary_op.ABS);\n const outInfo =
this.compileAndRun(program, [x]);\n return engine().makeTensorFromDataId(\n outInfo.dataId,
outInfo.shape, outInfo.dtype) as T;\n }\n\n makeTensorInfo(\n shape: number[], dtype: DataType,\n
values?: BackendValues|string[]): TensorInfo {\n let dataId;\n if (dtype === 'string' && values != null && values.length
> 0 &&\n util.isString(values[0])) {\n const encodedValues =\n (values as {}) as string[]).map(d =>
util.encodeString(d));\n dataId = this.write(encodedValues, shape, dtype);\n } else {\n dataId =
this.write(values as TypedArray, shape, dtype);\n }\n\n this.texData.get(dataId).usage = null;\n return {dataId,
shape, dtype};\n }\n\n private makeOutput<T extends Tensor>(\n shape: number[], dtype: DataType, values?: BackendValues): T {\n
const {dataId} = this.makeTensorInfo(shape, dtype, values);\n return engine().makeTensorFromDataId(dataId,
shape, dtype, this) as T;\n }\n\n private unpackTensor(input: TensorInfo): TensorInfo {\n const program = new

```

```

UnpackProgram(input.shape);\n return this.runWebGLProgram(program, [input], input.dtype);\n }\n\n private
packTensor(input: TensorInfo): TensorInfo {\n const program = new PackProgram(input.shape);\n const
preventEagerUnpackingOutput = true;\n return this.runWebGLProgram(\n program, [input], input.dtype, null
/* customSetup */, \n preventEagerUnpackingOutput);\n }\n\n private packedReshape(input: TensorInfo,
afterShape: number[]): TensorInfo {\n const input3DShape = [\n webgl_util.getBatchDim(input.shape), \n
...webgl_util.getRowsCols(input.shape)\n] as [number, number, number];\n const input3D: TensorInfo
= {\n dtype: input.dtype, \n shape: input3DShape, \n dataId: input.dataId\n }; \n const afterShapeAs3D =
[\n webgl_util.getBatchDim(afterShape), ...webgl_util.getRowsCols(afterShape)\n] as [number, number,
number];\n const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);\n const
preventEagerUnpackingOfOutput = true;\n const output = this.runWebGLProgram(\n program, [input3D],
input.dtype, null /* customSetup */, \n preventEagerUnpackingOfOutput);\n return { dataId: output.dataId,
shape: afterShape, dtype: output.dtype};\n }\n\n private decode(dataId: DataId): TensorInfo {\n const texData =
this.texData.get(dataId);\n const {isPacked, shape, dtype} = texData;\n const shapeAs3D = \n
webgl_util.getShapeAs3D(shape) as [number, number, number];\n let program;\n if (isPacked) {\n program =
new DecodeMatrixPackedProgram(shapeAs3D);\n } else {\n program = new
DecodeMatrixProgram(shapeAs3D);\n
\n }\n const preventEagerUnpackingOfOutput = true;\n const out = this.runWebGLProgram(\n program,
[{\n shape: shapeAs3D, dtype, dataId\n }], dtype, \n null /* customSetup */, preventEagerUnpackingOfOutput);\n
return { dtype, shape, dataId: out.dataId};\n }\n\n runWebGLProgram(\n program: GPGPUProgram, inputs:
TensorInfo[], outputDType: DataType, \n customSetup?: (gpgpu: GPGPUContext, WebGLProgram:
WebGLProgram) => void, \n preventEagerUnpackingOfOutput = false): TensorInfo {\n const output =
this.makeTensorInfo(program.outputShape, outputDType);\n const outData = this.texData.get(output.dataId);\n if
(program.packedOutput) {\n outData.isPacked = true;\n }\n if (program.outPackingScheme ===
tex_util.PackingScheme.DENSE) {\n const texelShape = tex_util.getDenseTexShape(program.outputShape);\n
// For a densely packed output, we explicitly set texShape\n // so it doesn't get assigned later according to our
typical packing\n
 // scheme wherein a single texel can only contain values from adjacent\n // rows/cols.\n outData.texShape
= texelShape.map(d => d * 2) as [number, number];\n }\n if (program.outTexUsage != null) {\n
outData.usage = program.outTexUsage;\n }\n if (util.sizeFromShape(output.shape) === 0) {\n // Short-circuit
the computation since the result is empty (has 0 in its\n // shape).\n outData.values = \n
util.getTypedArrayFromDType(output.dtype as 'float32', 0);\n return output;\n }\n const dataToDispose:
TensorInfo[] = [];\n const inputsData: TensorData[] = inputs.map(input => {\n if (input.dtype === 'complex64')
{\n throw new Error(\n `GPGPUProgram does not support complex64 input. For complex64 ` + \n
`dtypes, please separate the program into real and imaginary ` + \n
`parts.`);\n }\n });\n let texData =
this.texData.get(input.dataId);\n if (texData.texture ==
null) {\n if (!program.packedInputs &&\n util.sizeFromShape(input.shape) <= \n
env().getNumber('WEBGL_SIZE_UPLOAD_UNIFORM')) {\n // Upload small tensors that live on the CPU
as uniforms, not as\n // textures. Do this only when the environment supports 32bit floats\n // due to
problems when comparing 16bit floats with 32bit floats.\n //
\n TODO(https://github.com/tensorflow/tfjs/issues/821): Make it\n // possible for packed shaders to sample from
uniforms.\n return {\n shape: input.shape, \n texData: null, \n isUniform: true, \n
uniformValues: texData.values as TypedArray\n }; \n }\n }\n // This ensures that if a packed program's
inputs have not yet been\n // uploaded to the GPU, they get uploaded as packed right off the bat.\n if
(program.packedInputs) {\n texData.isPacked = true;\n texData.shape = input.shape;\n
\n }\n } else if (!texData.isPacked !== !program.packedInputs) {\n input = texData.isPacked ?
this.unpackTensor(input) : \n this.packTensor(input);\n dataToDispose.push(input);\n
\n texData = this.texData.get(input.dataId);\n } else if (\n texData.isPacked &&\n
!webgl_util.isReshapeFree(texData.shape, input.shape)) {\n // This is a special case where a texture exists for a

```

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tensor\n // but the shapes are incompatible (due to packing constraints) because\n // the tensor did not have
a chance to go through the packed reshape\n // shader. This only happens when we reshape the *same* tensor to
form\n // *distinct* inputs to an op, e.g. dotting a vector with itself. This\n // case will disappear once
packed uploading is the default.\n\n const savedInput = input;\n const targetShape = input.shape;\n\n input.shape = texData.shape;\n input =
 this.packedReshape(input as Tensor, targetShape);\n dataToDispose.push(input);\n texData =
 this.texData.get(input.dataId);\n\n savedInput.shape = targetShape;\n }\n\n this.uploadToGPU(input.dataId);\n return {shape: input.shape, texData, isUniform: false};\n });\n\n this.uploadToGPU(output.dataId);\n const outputData:\n TensorData = {shape: output.shape, texData:
 outData, isUniform: false};\n const key = gpgpu_math.makeShaderKey(program, inputsData, outputData);\n
 const binary = this.getAndSaveBinary(key, () => {\n return gpgpu_math.compileProgram(\n this.gpgpu,
 program, inputsData, outputData);\n });\n const shouldTimeProgram = this.activeTimers != null;\n let query:
 WebGLQuery|CPUTimerQuery;\n if (shouldTimeProgram) {\n query = this.startTimer();\n }\n\n gpgpu_math.runProgram(\n this.gpgpu, binary, inputsData, outputData, customSetup);\n\n dataToDispose.forEach(info => this.disposeIntermediateTensorInfo(info));\n\n if (shouldTimeProgram) {\n query = this.endTimer(query);\n this.activeTimers.push(\n {name:
 program.constructor.name, query: this.getQueryTime(query)});\n }\n\n if
 (!env().getBool('WEBGL_LAZILY_UNPACK') && outData.isPacked &&\n preventEagerUnpackingOfOutput
 === false) {\n const unpacked = this.unpackTensor(output);\n this.disposeIntermediateTensorInfo(output);\n
 return unpacked;\n }\n return output;\n });\n\n compileAndRun(\n program: GPGPUProgram, inputs:
 TensorInfo[], outputDtype?: DataType,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram:
 WebGLProgram) => void,\n preventEagerUnpackingOfOutput = false): TensorInfo {\n outputDtype =
 outputDtype || inputs[0].dtype;\n const outInfo = this.runWebGLProgram(\n program, inputs, outputDtype,
 customSetup,\n preventEagerUnpackingOfOutput);\n return outInfo;\n }\n\n private getAndSaveBinary(key:
 string, getBinary:
 () => GPGPUBinary):\n GPGPUBinary {\n if (!(key in this.binaryCache)) {\n this.binaryCache[key] =
 getBinary();\n }\n return this.binaryCache[key];\n }\n\n getTextureManager(): TextureManager {\n return
 this.textureManager;\n }\n\n private disposed = false;\n\n dispose() {\n if (this.disposed) {\n return;\n }\n
 // Avoid disposing the compiled webgl programs during unit testing because\n // it slows down test execution.\n
 if (!env().getBool('IS_TEST')) {\n const allKeys = Object.keys(this.binaryCache);\n allKeys.forEach(key =>
 {\n this.gpgpu.deleteProgram(this.binaryCache[key].webGLProgram);\n delete this.binaryCache[key];\n
 });\n }\n this.textureManager.dispose();\n if (this.canvas != null &&\n (typeof (HTMLCanvasElement)
 != 'undefined' &&\n this.canvas instanceof HTMLCanvasElement)) {\n this.canvas.remove();\n } else
 {\n this.canvas = null;\n }\n if (this.gpgpuCreatedLocally)
 {\n this.gpgpu.program = null;\n this.gpgpu.dispose();\n }\n this.disposed = true;\n }\n\n
 floatPrecision(): 16|32 {\n if (this.floatPrecisionValue == null) {\n this.floatPrecisionValue = tidy() => {\n
 if (!env().get('WEBGL_RENDER_FLOAT32_ENABLED')) {\n // Momentarily switching DEBUG flag to
 false so we don't throw an\n // error trying to upload a small value.\n const debugFlag =
 env().getBool('DEBUG');\n env().set('DEBUG', false);\n const underflowCheckValue =
 this.abs(scalar(1e-8)).dataSync()[0];\n env().set('DEBUG', debugFlag);\n\n if (underflowCheckValue >
 0) {\n return 32;\n }\n }\n return 16;\n });\n }\n return this.floatPrecisionValue;\n }\n\n
 /** Returns the smallest representable number. */\n epsilon(): number {\n return this.floatPrecision() === 32 ?
 EPSILON_FLOAT32 : EPSILON_FLOAT16;\n }\n\n uploadToGPU(dataId: DataId):
 void {\n const texData = this.texData.get(dataId);\n const {shape, dtype, values, texture, usage, isPacked} =
 texData;\n\n if (texture != null) {\n // Array is already on GPU. No-op.\n return;\n }\n const
 shouldTimeProgram = this.activeTimers != null;\n let start: number;\n if (shouldTimeProgram) {\n start =
 util.now();\n }\n\n let texShape = texData.texShape;\n if (texShape == null) {\n texShape =
 webgl_util.getTextureShapeFromLogicalShape(shape, isPacked);\n texData.texShape = texShape;\n }\n\n if

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(values != null) {\n const shapeAs3D = webgl_util.getShapeAs3D(shape);\n\n let program;\n let width = texShape[1], height = texShape[0];\n const isByteArray = values instanceof Uint8Array;\n\n if (isPacked) {\n [width, height] = tex_util.getPackedMatrixTextureShapeWidthHeight(\n texShape[0], texShape[1]);\n program = new EncodeMatrixPackedProgram(\n shapeAs3D, [height, width], isByteArray);\n } else {\n program = new EncodeMatrixProgram(shapeAs3D, [height, width], isByteArray);\n }\n\n const tempDenseInputHandle = this.makeTensorInfo([height, width], dtype);\n if (isByteArray) {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.PIXELS;\n } else {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.UPLOAD;\n }\n\n this.gpgpu.uploadDenseMatrixToTexture(\n this.getTexture(tempDenseInputHandle.dataId), width, height,\n values as TypedArray);\n\n // We want the output to remain packed regardless of the value of\n // WEBGL_PACK.\n const preventEagerUnpacking = true;\n const encodedOutputTarget =\n this.runWebGLProgram(\n program, [tempDenseInputHandle], dtype, null, preventEagerUnpacking);\n\n // Have the original texture assume the identity of the encoded output.\n const\n outputTexData = this.texData.get(encodedOutputTarget.dataId);\n texData.texture = outputTexData.texture;\n texData.texShape = outputTexData.texShape;\n texData.isPacked = outputTexData.isPacked;\n texData.usage = outputTexData.usage;\n\n this.disposeIntermediateTensorInfo(tempDenseInputHandle);\n\n this.texData.delete(encodedOutputTarget.dataId);\n\n // Once uploaded, don't store the values on cpu.\n texData.values = null;\n\n if (shouldTimeProgram) {\n this.uploadWaitMs += util.now() - start;\n }\n\n else {\n const newTexture = this.acquireTexture(texShape, usage, dtype, isPacked);\n texData.texture = newTexture;\n }\n\n private convertAndCacheOnCPU(dataId: DataId, float32Values?: Float32Array):\n TypedArray {\n const texData = this.texData.get(dataId);\n const {dtype} = texData;\n\n this.releaseGPUData(dataId);\n\n if (float32Values != null) {\n texData.values = float32ToTypedArray(float32Values,\n dtype as 'float32');\n }\n\n return texData.values as TypedArray;\n }\n\n private acquireTexture(\n texShape: [number, number], texType: TextureUsage, dtype: DataType,\n isPacked: boolean): WebGLTexture {\n this.numBytesInGPU += this.computeBytes(texShape, dtype);\n if (!this.warnedAboutMemory &&\n this.numBytesInGPU > this.numMBBeforeWarning * 1024 * 1024) {\n const mb = (this.numBytesInGPU / 1024 / 1024).toFixed(2);\n this.warnedAboutMemory = true;\n console.warn(\n `High memory usage in GPU: ${mb} MB, `+\n `most likely due to a memory leak`);\n }\n return this.textureManager.acquireTexture(texShape, texType, isPacked);\n }\n\n private computeBytes(shape: [number, number], dtype: DataType) {\n return shape[0] * shape[1] * util.bytesPerElement(dtype);\n }\n\n float32ToTypedArray<D extends NumericDataType>(\n a: Float32Array, dtype: D): tf.DataTypeMap[D] {\n if (dtype === 'float32' ||\n dtype === 'complex64') {\n return a as tf.DataTypeMap[D];\n }\n else if (dtype === 'int32' || dtype === 'bool') {\n const result = (dtype === 'int32') ? new Int32Array(a.length) :\n new Uint8Array(a.length);\n for (let i = 0; i < result.length; ++i) {\n result[i] = Math.round(a[i]);\n }\n return result as tf.DataTypeMap[D];\n }\n else {\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n *\n import {env} from '@tensorflow/tfjs-core';\n import * as gpgpu_util from './gpgpu_util';\n import * as webgl_util from './webgl_util';\n export {MathBackendWebGL, WebGLMemoryInfo, WebGLTimingInfo} from\n './backend_webgl';\n export {setWebGLContext} from './canvas_util';\n export {GPGPUContext} from './gpgpu_context';\n export {GPGPUProgram} from './gpgpu_math';\n\n // WebGL specific utils.\n export {gpgpu_util,

```

```
webgl_util};\n\n/**\n * Enforce use of half precision textures if available on the platform.\n *\n * @doc {heading:
'Environment', namespace: 'webgl'}\n *\nexport function forceHalfFloat(): void {\n
env().set('WEBGL_FORCE_F16_TEXTURES', true);\n}\n\n", "/*\n * @license\n * Copyright 2017 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport const CHECK_NAN_SNIPPET = \n if (isnan(a)) return a;\n if (isnan(b)) return
b;\n`;\n\nexport const SQUARED_DIFFERENCE = 'return (a - b) * (a - b);';\n\nexport class BinaryOpProgram
implements GPGPUProgram {\n variableNames = ['A', 'B'];\n outputShape: number[];\n userCode: string;\n\n constructor(op: string, aShape: number[],
bShape: number[]) {\n this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);\n
this.userCode = \n float binaryOperation(float a, float b) {\n ${op}\n }\n\n void main() {\n float a
= getAAtOutCoords();\n float b = getBAtOutCoords();\n setOutput(binaryOperation(a, b));\n }\n }\n}\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nimport {getChannels} from './packing_util';\n\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport const CHECK_NAN_SNIPPET = \n result.r = isNaN.r > 0. ? NAN : result.r;\n
result.g = isNaN.g > 0. ? NAN : result.g;\n result.b = isNaN.b > 0. ? NAN : result.b;\n result.a = isNaN.a > 0. ?
NAN : result.a;\n`;\n\nexport const ELU_DER = \n vec4 bGTEZero = vec4(greaterThanEqual(b, vec4(0.)));;\n
return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));\n`;\n\nexport const NOT_EQUAL = \n
return vec4(notEqual(a, b));\n`;\n\nexport class BinaryOpPackedProgram implements GPGPUProgram {\n
 variableNames = ['A', 'B'];\n outputShape: number[];\n userCode: string;\n supportsBroadcasting = true;\n
packedInputs = true;\n packedOutput = true;\n\n constructor(\n
 op: string, aShape: number[], bShape: number[],\n checkOutOfBounds = false) {\n this.outputShape =
backend_util.assertAndGetBroadcastShape(aShape, bShape);\n const rank = this.outputShape.length;\n let
checkOutOfBoundsString = ";\n if (checkOutOfBounds) {\n if (rank === 0 ||
util.sizeFromShape(this.outputShape) === 1) {\n checkOutOfBoundsString = \n result.y = 0.;\n
result.z = 0.;\n result.w = 0.;\n `;\n } else {\n const dtype = getCoordsDataType(rank);\n
checkOutOfBoundsString = \n ${dtype} coords = getOutputCoords();\n `;\n if (rank === 1) {\n
checkOutOfBoundsString += \n result.y = (coords + 1) >= ${this.outputShape[0]} ? 0. : result.y;\n
result.z = 0.;\n result.w = 0.;\n `;\n } else {\n const channels = getChannels('coords', rank);\n
checkOutOfBoundsString += \n bool nextRowOutOfBounds
=\n (${channels[rank - 2]} + 1) >= ${this.outputShape[rank - 2]};\n bool nextColOutOfBounds =\n
 (${channels[rank - 1]} + 1) >= ${this.outputShape[rank - 1]};\n result.y = nextColOutOfBounds ? 0. :
result.y;\n result.z = nextRowOutOfBounds ? 0. : result.z;\n result.w = nextColOutOfBounds ||
nextRowOutOfBounds ? 0. : result.w;\n `;\n }\n }\n }\n\n this.userCode = \n vec4
```

```

binaryOperation(vec4 a, vec4 b) {
 op
}

void main() {
 vec4 a = getAAtOutCoords();
 vec4 b = getBAtOutCoords();
 vec4 result = binaryOperation(a, b);
 checkOutOfBoundsString
 setOutput(result);
}

/*
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
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 * you may not use this file except in compliance with the License.
 * You may obtain
 * a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by
 * applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS"
 * BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the
 * License for the specific language governing permissions and
 * limitations under the License.

```

```

=====
*/
import {env, KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {BinaryOpProgram} from './binaryop_gpu';
import {BinaryOpPackedProgram} from
'./binaryop_packed_gpu';
export const LEAKYRELU = `return (a < 0.) ? b * a : a`;
export const
LEAKYRELU_PACKED = `
 vec4 aLessThanZero = vec4(lessThan(a, vec4(0.)));
 return (aLessThanZero * (b
 * a) + ((vec4(1.0) - aLessThanZero
 * a));
`;
export function leakyRelu(args: {
 inputs: LeakyReluInputs,
 backend: MathBackendWebGL,
 attrs: LeakyReluAttrs}): TensorInfo {
 const {inputs, backend, attrs} = args;
 const {x} = inputs;
 const
 {alpha} = attrs;
 const $alpha = backend.makeTensorInfo([], 'float32',
 util.createScalarValue(alpha as
 { } as 'float32', 'float32'));
 const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?
 new BinaryOpPackedProgram(LEAKYRELU_PACKED, x.shape, $alpha.shape) :
 new
 BinaryOpProgram(LEAKYRELU, x.shape, $alpha.shape);
 const result = backend.runWebGLProgram(program,
 [x, $alpha], x.dtype);
 backend.disposeIntermediateTensorInfo($alpha);
 return result;
}
export const
leakyReluConfig: KernelConfig = {
 kernelName: LeakyRelu,
 backendName: 'webgl',
 kernelFunc: leakyRelu
as { } as KernelFunc};
/*
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```

=====
*/
import {env, KernelConfig, KernelFunc, Prelu, PreluInputs, TensorInfo}
from '@tensorflow/tfjs-
core';
import {MathBackendWebGL} from '../backend_webgl';
import {BinaryOpProgram} from
'./binaryop_gpu';
import {BinaryOpPackedProgram} from './binaryop_packed_gpu';
export const PRELU =
`return (a < 0.) ? b * a : a`;
export const PRELU_PACKED = `
 vec4 aLessThanZero = vec4(lessThan(a,
 vec4(0.)));
 return (aLessThanZero * (b * a) + ((vec4(1.0) - aLessThanZero) * a));
`;
export function
prelu(args: {inputs: PreluInputs, backend: MathBackendWebGL}): TensorInfo {
 const {inputs, backend} =
 args;
 const {x, alpha} = inputs;
 const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?
 new BinaryOpPackedProgram(PRELU_PACKED, x.shape, alpha.shape) :
 new
 BinaryOpProgram(PRELU, x.shape, alpha.shape);
 return backend.runWebGLProgram(program, [x, alpha],
 x.dtype);
}
export const preluConfig: KernelConfig = {
 kernelName: Prelu,
 backendName: 'webgl',
 kernelFunc: prelu
as { } as KernelFunc};
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```
=====
*\n\nimport {backend_util, BinaryInputs, DataType, env, KernelFunc, TypedArray, UnaryInputs, upcastType}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport
{BinaryOpProgram} from './binaryop_gpu';\nimport {BinaryOpPackedProgram} from
'./binaryop_packed_gpu';\nimport {complex} from './kernels/Complex';\nimport {LEAKYRELU,
LEAKYRELU_PACKED} from './kernels/LeakyRelu';\nimport {PRELU, PRELU_PACKED} from
'./kernels/Prelu';\nimport * as unary_op from './unaryop_gpu';\nimport {UnaryOpProgram} from
'./unaryop_gpu';\nimport * as unary_packed_op from './unaryop_packed_gpu';\nimport
{UnaryOpPackedProgram} from './unaryop_packed_gpu';\n\nimport {SimpleBinaryKernelImplCPU,
SimpleUnaryKernelImplCPU} from './shared';\n\nexport const CHECK_NAN_SNIPPET_UNARY = `if (isnan(x))
return x;`\n\nexport const CHECK_NAN_SNIPPET_BINARY = `\n if (isnan(a)) return a;\n if (isnan(b)) return
b;\n`;\n\nexport const CHECK_NAN_SNIPPET_BINARY_PACKED = `\n result.r = isNaN.r > 0. ? NAN :
result.r;\n result.g = isNaN.g > 0. ? NAN : result.g;\n result.b = isNaN.b > 0. ? NAN : result.b;\n result.a = isNaN.a
> 0. ? NAN : result.a;\n`;\n\ntype UnaryKernelFuncConfig = {\n opSnippet: string,\n packedOpSnippet?: string,\n
cpuKernelImpl?: SimpleUnaryKernelImplCPU,\n dtype?: DataType\n};\n\n/**\n * Template that creates a
`KernelFunc` for unary ops.\n * @param opSnippet Op snippet to create `UnaryOpProgram`\n * @param
packedOpSnippet Op snippet to create `UnaryOpPackedProgram`\n * @param dtype Optional. If set, the result has
this dtype. Otherwise, the\n *
result has the same dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less,
Greater, etc.\n */\nexport function unaryKernelFunc(\n {opSnippet, packedOpSnippet, cpuKernelImpl, dtype}:
UnaryKernelFuncConfig):\n KernelFunc {\n return ({inputs, backend}) => {\n const {x} = inputs as
UnaryInputs;\n const webglBackend = backend as MathBackendWebGL;\n\n const $dtype = dtype || x.dtype;\n
if (webglBackend.shouldExecuteOnCPU([x]) && cpuKernelImpl != null) {\n const xData =
webglBackend.texData.get(x.dataId);\n const outValues = cpuKernelImpl(xData.values as TypedArray,
$dtype);\n return webglBackend.makeTensorInfo(x.shape, $dtype, outValues);\n }\n\n const
shouldUsePackedProgram =\n env().getBool('WEBGL_PACK_UNARY_OPERATIONS') &&
packedOpSnippet != null;\n let program: UnaryOpProgram|UnaryOpPackedProgram;\n if
(shouldUsePackedProgram) {\n program = new UnaryOpPackedProgram(x.shape, packedOpSnippet);\n
} else {\n program = new UnaryOpProgram(x.shape, opSnippet);\n }\n\n return
webglBackend.runWebGLProgram(program, [x], $dtype);\n };\n}\n\ntype BinaryKernelFuncConfig = {\n
opSnippet: string,\n packedOpSnippet?: string,\n checkOutOfBounds?: boolean,\n supportsComplex?: boolean,\n
cpuKernelImpl?: SimpleBinaryKernelImplCPU,\n dtype?: DataType\n};\n\n/**\n * Template that creates a
`KernelFunc` for binary ops.\n * @param opSnippet Op snippet to create `BinaryOpProgram`\n * @param
packedOpSnippet Op snippet to create `BinaryOpPackedProgram`\n * @param
checkOutOfBoundsForPackedProgram Whether to set checkOutOfBounds=true\n * when creating
BinaryOpPackedProgram.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result
has the same dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less, Greater,
etc.\n */\nexport function binaryKernelFunc({\n opSnippet,\n packedOpSnippet,\n checkOutOfBounds
= false,\n supportsComplex = false,\n cpuKernelImpl,\n dtype\n}: BinaryKernelFuncConfig): KernelFunc {\n
return ({inputs, backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const webglBackend = backend as
MathBackendWebGL;\n\n if (supportsComplex && a.dtype === 'complex64') {\n const aData =
webglBackend.texData.get(a.dataId);\n const bData = webglBackend.texData.get(b.dataId);\n\n const [real,
imag] = [\n [aData.complexTensorInfos.real, bData.complexTensorInfos.real],\n
[aData.complexTensorInfos.imag, bData.complexTensorInfos.imag]\n].map(complexParts => {\n const
[aPart, bPart] = complexParts;\n\n const aHandle = {\n dataId: aPart.dataId,\n dtype: aPart.dtype,\n
shape: a.shape\n };\n const bHandle = {\n dataId: bPart.dataId,\n dtype: bPart.dtype,\n
shape: b.shape\n };\n\n const program = new BinaryOpProgram(opSnippet, a.shape,
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b.shape);\n return webglBackend.runWebGLProgram(\n program, [aHandle, bHandle],
upcastType(aPart.dtype, bPart.dtype));\n });\n\n const complexOutput =\n complex({inputs: {real,
imag}, backend: webglBackend});\n\n webglBackend.disposeIntermediateTensorInfo(real);\n webglBackend.disposeIntermediateTensorInfo(imag);\n\n // TODO(annxingyuan): Implement CPU forwarding
for complex inputs.\n\n return complexOutput;\n }\n\n const $dtype = dtype || upcastType(a.dtype,
b.dtype);\n if (webglBackend.shouldExecuteOnCPU([a, b]) && cpuKernelImpl != null) {\n const aData =
webglBackend.texData.get(a.dataId);\n const bData = webglBackend.texData.get(b.dataId);\n const
[outValues, outShape] = cpuKernelImpl(\n a.shape, b.shape, aData.values as TypedArray,\n bData.values
as TypedArray, $dtype);\n const out = webglBackend.makeTensorInfo(outShape, $dtype);\n const outData
= webglBackend.texData.get(out.dataId);\n
 outData.values = outValues;\n return out;\n }\n\n const shouldUsePackedProgram =\n env().getBool('WEBGL_PACK_BINARY_OPERATIONS') &&\n packedOpSnippet != null;\n let program:
BinaryOpProgram|BinaryOpPackedProgram;\n if (shouldUsePackedProgram) {\n program = new
BinaryOpPackedProgram(\n packedOpSnippet, a.shape, b.shape, checkOutOfBounds);\n } else {\n
program = new BinaryOpProgram(opSnippet, a.shape, b.shape);\n }\n\n return
webglBackend.runWebGLProgram(program, [a, b], $dtype);\n };\n\n\nexport function
mapActivationToShaderProgram(\n activation: backend_util.Activation, packed = false): string {\n if (activation
=== 'linear') {\n if (packed) {\n return unary_packed_op.LINEAR;\n }\n return unary_op.LINEAR;\n }
else if (activation === 'relu') {\n if (packed) {\n return unary_packed_op.RELU;\n }\n return
unary_op.RELU;\n } else if (activation === 'elu') {\n if (packed)
{\n return unary_packed_op.ELU;\n }\n return unary_op.ELU;\n } else if (activation === 'relu6') {\n if
(packed) {\n return unary_packed_op.RELU6;\n }\n return unary_op.RELU6;\n } else if (activation ===
'prelu') {\n if (packed) {\n return PRELU_PACKED;\n }\n return PRELU;\n } else if (activation ===
'leakyrelu') {\n if (packed) {\n return LEAKYRELU_PACKED;\n }\n return LEAKYRELU;\n }\n\n throw
new Error(`Activation ${\n activation} has not been implemented for the WebGL backend.`);\n }\n\n "/**\n *
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */\n */\n\n
=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class MatMulPackedProgram implements
GPGPUProgram {\n variableNames = ['matrixA', 'matrixB'];\n packedInputs = true;\n packedOutput = true;\n
outputShape: number[];\n userCode: string;\n\n constructor(\n aShape: [number, number, number], bShape:
[number, number, number],\n outputShape: [number, number, number], transposeA = false,\n transposeB =
false, addBias = false, activation: string = null,\n hasPreluActivation = false, hasLeakyreluActivation = false) {\n
this.outputShape = outputShape;\n\n const sharedDim = transposeA ? aShape[1] : aShape[2];\n const
sharedDimensionPacked = Math.ceil(sharedDim / 2);\n\n const aSample
= transposeA ? 'i * 2, rc.y' : 'rc.y, i * 2';\n const bSample = transposeB ? 'rc.z, i * 2' : 'i * 2, rc.z';\n const
aSwizzle = transposeA ? ['a.xyy', 'a.zzww'] : ['a.xzz', 'a.yyww'];\n const bSwizzle = transposeB ? ['b.xzz',
'b.yyyw'] : ['b.xxyy', 'b.zzww'];\n\n let activationSnippet = "", applyActivationSnippet = ""; \n if (activation) {\n
if (hasPreluActivation) {\n activationSnippet = `vec4 activation(vec4 a) {\n vec4 b =
getPreluActivationWeightsAtOutCoords();\n ${activation}\n }`; \n } else if (hasLeakyreluActivation)
{\n activationSnippet = `vec4 activation(vec4 a) {\n vec4 b = getLeakyreluAlphaAtOutCoords();\n
${activation}\n }`; \n } else {\n activationSnippet = `vec4 activation(vec4 x) {\n
${activation}\n }`; \n }\n\n applyActivationSnippet = `result = activation(result);`\n }\n\n const addBiasSnippet = addBias
? 'result += getBiasAtOutCoords()';

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: ";
if (addBias) {
 this.variableNames.push('bias');
}
if (hasPreluActivation) {
 this.variableNames.push('preluActivationWeights');
}
if (hasLeakyreluActivation) {
 this.variableNames.push('leakyreluAlpha');
}
let batchASnippet = 'rc.x';
let batchBSnippet = 'rc.x';
if (aShape[0] < bShape[0]) {
 batchASnippet = `int(min(float(rc.x), ${aShape[0] - 1}))`;
} else if (bShape[0] < aShape[0]) {
 batchBSnippet = `int(min(float(rc.x), ${bShape[0] - 1}))`;
}
this.userCode = `
 ${activationSnippet}
 const float sharedDimension = ${sharedDimensionPacked}.0;
 vec4 dot2x2ARowBCol(ivec3 rc) {
 vec4 result = vec4(0);
 for (int i = 0; i < ${sharedDimensionPacked}; i++) {
 int batchA = ${batchASnippet};
 int batchB = ${batchBSnippet};
 vec4 a = getMatrixA(batchA, ${aSample});
 vec4 b = getMatrixB(batchB, ${bSample});
 // These swizzled products need to be separately added. // See:
 https://github.com/tensorflow/tfjs/issues/1735
 result += (${aSwizzle[0]} * ${bSwizzle[0]});
 result += (${aSwizzle[1]} * ${bSwizzle[1]});
 }
 return result;
 }
 void main() {
 ivec3 rc = getOutputCoords();
 vec4 result = dot2x2ARowBCol(rc);
 ${addBiasSnippet}
 ${applyActivationSnippet}
 setOutput(result);
 }
`;
}
}
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 * permissions and limitations under the License.
 */
=====
*
* \n
import { backend_util } from '@tensorflow/tfjs-core';
import { GPGPUProgram } from './gpgpu_math';
(Ar + Ai)(Br + Bi) = ArBr + ArBi + AiBr + AiBi = ArBr - AB + ArBi + AiBr
// Yr = ArBr - AB // Yi = ArBi + AiBr
export const COMPLEX_MULTIPLY = {
 REAL: 'return areal * breal - aimag * bimag;',
 IMAG: 'return areal * bimag + aimag * breal;'};
export class BinaryOpComplexProgram implements GPGPUProgram {
 variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];
 userCode: string;
 outputShape: number[];
 constructor(op: string, aShape: number[], bShape: number[]) {
 this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
 this.userCode = `
float binaryOpComplex(float areal, float aimag, float breal, float bimag) {
 ${op}
}
void main() {
 float areal = getARealAtOutCoords();
 float aimag = getAImagAtOutCoords();
 float breal = getBRealAtOutCoords();
 float bimag = getBImagAtOutCoords();
 setOutput(binaryOpComplex(areal, aimag, breal, bimag));
}
`;
}
}
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 */
*
=====
*
import { TensorInfo } from '@tensorflow/tfjs-core';
import { MathBackendWebGL } from './backend_webgl';
import { ReshapePackedProgram } from './reshape_packed_gpu';
import { getBatchDim, getRowsCols } from './webgl_util';
export function packedReshape(input: TensorInfo, afterShape: number[], backend: MathBackendWebGL): TensorInfo {
 const input3DShape = [getBatchDim(input.shape), ...getRowsCols(input.shape)] as [number, number, number];
 const input3D: TensorInfo = {
 dtype: input.dtype,
 shape: input3DShape,
 dataId: input.dataId};
 const afterShapeAs3D = [getBatchDim(afterShape), ...getRowsCols(afterShape)] as [number, number,

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number];\n\n const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);\n const
preventEagerUnpackingOfOutput = true;\n const output = backend.runWebGLProgram(\n program, [input3D],
input.dtype,
 null /* customSetup */,\n preventEagerUnpackingOfOutput);\n return {dataId: output.dataId, shape: afterShape,
dtype: output.dtype};\n}\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {packedReshape} from './kernel_utils/reshape';\n\nimport
{isReshapeFree} from './webgl_util';\n\n\nexport function reshape(args: {\n inputs: ReshapeInputs,\n backend:
MathBackendWebGL,\n attrs: ReshapeAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x}
= inputs;\n const {shape} = attrs;\n const webglBackend = backend;\n\n const xSize =
util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n const $xSize =
util.sizeFromShape($shape);\n\n util.assert(\n xSize === $xSize,\n () => `The new shape (${ $shape }) has
${ $xSize } elements and the old ` +\n `shape (${ x.shape }) has ${ xSize } elements. The new shape and old ` +\n
 `shape must have the same number of elements.`);\n\n const xTexData =
webglBackend.texData.get(x.dataId);\n if (xTexData.isPacked && !isReshapeFree(x.shape, $shape) &&\n
!(xTexData.texture !== null && isReshapeFree(xTexData.shape,
 $shape))) {\n return packedReshape(x, $shape, webglBackend);\n }\n\n webglBackend.incRef(x.dataId);\n\n
return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'webgl',\n kernelFunc: reshape as {} as KernelFunc\n};\n", "/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {backend_util, util} from 'tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\n\nexport class MeanProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(reduceInfo: backend_util.ReduceInfo, divisor?:
number) {\n const {windowSize, batchSize, inSize, outSize} = reduceInfo;\n this.outputShape = [batchSize,
outSize];\n\n const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n const
windowSizeVec4Remainder = windowSize % 4;\n\n let updateSnippet = `sumValue += dot(values, ones);`;\n if
(divisor !== null) {\n const denominator = 1 / divisor;\n updateSnippet = `sumValue += dot(values * ${\n
util.isInt(denominator) ? denominator.toPrecision(2) :\n denominator}, ones);`;\n }\n\n let
checkOutOfBounds = `;\n if (inSize % windowSize > 0) {\n checkOutOfBounds
= `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return 0.0;\n }\n `;\n }\n\n this.userCode = `\n
const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n float getValue(int batch, int inIdx) {\n
${checkOutOfBounds}\n return getX(batch, inIdx);\n }\n\n void main() {\n ivec2 coords =
getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n int inOffset = outIdx *
${windowSize};\n\n float sumValue = 0.0;\n for (int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n

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int inIdx = inOffset + i;\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch,\n inIdx + 1),\n getValue(batch, inIdx + 2),\n getValue(batch, inIdx + 3));\n);\n $\{updateSnippet}\n }\n int inIdx = inOffset + $\{windowSizeNearestVec4};\n if\n ($\{windowSizeVec4Remainder === 1}) {\n vec4 values =\n vec4(getValue(batch, inIdx), 0.0, 0.0, 0.0);\n $\{updateSnippet}\n } else if\n ($\{windowSizeVec4Remainder === 2}) {\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1), 0.0, 0.0);\n $\{updateSnippet}\n } else if ($\{windowSizeVec4Remainder\n === 3}) {\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2), 0.0);\n $\{updateSnippet}\n }\n setOutput(sumValue);\n }\n `;\n}\n}\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License\n * is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n *
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=====\n*\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n './gpgpu_math';\nexport class ReduceProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n constructor(\n reduceInfo: backend_util.ReduceInfo,\n reduceType: 'all'|'any'|'max'|'min'|'sum'|'prod') {\n const {windowSize, batchSize, inSize, outSize} = reduceInfo;\n this.outputShape = [batchSize, outSize];\n let initializationValue = '0.0';\n let compareOp = ``;\n if\n (reduceType === 'prod') {\n initializationValue = '1.0';\n } else if (reduceType === 'min') {\n // WebGL on\n Firefox Linux can't compile\n 1/0 so we do 1/eps.\n initializationValue = '1.0 / 1e-20';\n compareOp = `min`;\n } else if (reduceType ===\n 'max') {\n // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.\n initializationValue = '-1.0 / 1e-\n 20';\n compareOp = `max`;\n }\n let returnValue = `${reduceType}(${reduceType}(${reduceType})\n ^ +\n 'minMaxValue[0], minMaxValue[1], minMaxValue[2], minMaxValue[3]);`\n if (reduceType === 'sum') {\n returnValue = `sumValue`;\n } else if (reduceType === 'prod') {\n returnValue = `prodValue`;\n } else if\n (reduceType === 'all') {\n returnValue = `allValue`;\n } else if (reduceType === 'any') {\n returnValue =\n `anyValue`;\n }\n const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n const\n windowSizeVec4Remainder = windowSize % 4;\n let updateSnippet = `\n if ($\{reduceType === 'sum'}) {\n sumValue += dot(values, ones);\n } else if ($\{reduceType === 'prod'}) {\n vec2 tmp = vec2(values[0], values[1]) * vec2(values[2], values[3]);\n prodValue *= tmp[0] * tmp[1];\n }\n else {\n minMaxValue = ${compareOp}(values, minMaxValue);\n }\n `;\n let vecType = `vec4`;\n if (reduceType === 'all') {\n initializationValue = '1.0';\n updateSnippet = `\n bool reducedAllValue =\n all(values);\n float floatedReducedAllValue = float(reducedAllValue);\n allValue = float(allValue >= 1.0\n && floatedReducedAllValue >= 1.0);\n `;\n vecType = `bvec4`;\n } else if (reduceType === 'any') {\n initializationValue = '0.0';\n updateSnippet = `\n bool reducedAnyValue = any(values);\n float\n floatedReducedAnyValue = float(reducedAnyValue);\n anyValue = float(anyValue >= 1.0 ||\n floatedReducedAnyValue >= 1.0);\n `;\n vecType = `bvec4`;\n }\n let checkOutOfBounds = ``;\n if\n (inSize % windowSize > 0) {\n checkOutOfBounds = `\n if (inIdx < 0\n || inIdx >= ${inSize}) {\n return initializationValue;\n }\n `;\n }\n this.userCode = `\n const\n float initializationValue = ${initializationValue};\n const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n float\n getValue(int batch, int inIdx) {\n ${checkOutOfBounds}\n return getX(batch, inIdx);\n }\n void\n main() {\n ivec2 coords = getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n int inOffset = outIdx * $\{windowSize};\n vec4 minMaxValue = vec4(${initializationValue});\n float\n prodValue = 1.0;\n float sumValue = 0.0;\n float allValue = 1.0;\n float anyValue = 0.0;\n for
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(int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n int inIdx = inOffset + i;\n ${vecType} values =\n ${vecType}(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch,\n2),\n getValue(batch,\n inIdx + 3)\n);\n ${updateSnippet}\n }\n int inIdx = inOffset +\n ${windowSizeNearestVec4};\n if (${windowSizeVec4Remainder === 1}) {\n ${vecType} values =\n ${vecType}(\n getValue(batch, inIdx),\n initializationValue,\n initializationValue,\n initializationValue\n);\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder === 2}) {\n ${vecType} values = ${vecType}(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n initializationValue,\n initializationValue\n);\n ${updateSnippet}\n } else if\n (${windowSizeVec4Remainder === 3}) {\n ${vecType} values = ${vecType}(\n getValue(batch,\n inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n initializationValue\n);\n ${updateSnippet}\n }\n setOutput(${returnValue});\n }\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {backend_util, DataType, TensorInfo} from '@tensorflow/tfjs-core';\nimport\n{MathBackendWebGL} from '../backend_webgl';\nimport {MeanProgram} from '../mean_gpu';\nimport\n{ReduceProgram} from '../reduce_gpu';\n\ntype\nReduceTypes = 'all'|'any'|'max'|'min'|'sum'|'prod'|'mean';\n\n// Returns an array of configuration objects that describe\n each stage of the\n// reduction.\nfunction getReductionStages(inShape: number[]):\n Array<{\n inSize: number,\n windowSize: number, outSize: number}> {\n const stages = [];\n while (stages.length === 0 ||\n stages[stages.length - 1].outSize !== 1) {\n const outSize: number =\n stages.length ? stages[stages.length -\n1].outSize : inShape[1];\n const windowSize = backend_util.computeOptimalWindowSize(outSize);\n stages.push({\n inSize: outSize,\n windowSize,\n outSize: Math.ceil(outSize / windowSize)\n });\n }\n return stages;\n}\n\nexport function reduce(\n x: TensorInfo, dtype: DataType, reductionType: ReduceTypes,\n backend: MathBackendWebGL): TensorInfo {\n const reductionStages = getReductionStages(x.shape);\n let\n result = x;\n for (let i = 0; i < reductionStages.length; i++) {\n const {inSize,\n windowSize, outSize} = reductionStages[i];\n let program: ReduceProgram|MeanProgram;\n let\n previousResult: TensorInfo;\n if (reductionType === 'mean') {\n program = i === 0 ?\n new\n MeanProgram(\n {windowSize, inSize, batchSize: x.shape[0], outSize}, inSize) :\n new\n MeanProgram({windowSize, inSize, batchSize: x.shape[0], outSize});\n } else {\n program = new\n ReduceProgram(\n {windowSize, inSize, batchSize: x.shape[0], outSize}, reductionType);\n }\n previousResult = result;\n result = backend.runWebGLProgram(program, [result], dtype);\n if\n (previousResult.dataId !== x.dataId) {\n backend.disposeIntermediateTensorInfo(previousResult);\n }\n }\n return result;\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy\n of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {GPGPUProgram} from '../gpgpu_math';\nimport {getCoordsDataType} from

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x.shape.length;\n\n const origAxes = util.parseAxisParam(reductionIndices, x.shape);\n let axes = origAxes;\n
const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const sumInputIsTransposed =
permutedAxes != null;\n\n let sumInput = x;\n if (sumInputIsTransposed) {\n sumInput = transposeImpl(x,
permutedAxes, backend);\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n } \n\n
backend_util.assertAxesAreInnerMostDims('sum', axes, xRank);\n const [sumOutShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(sumInput.shape, axes);\n\n
let outShape = sumOutShape;\n if (keepDims) {\n // rather than reshape at the end, set the target shape here.\n
outShape = backend_util.expandShapeToKeepDim(sumOutShape, origAxes);\n } \n\n const inSize =
util.sizeFromShape(reduceShape);\n const xSize = util.sizeFromShape(x.shape);\n const batchSize = xSize /
inSize;\n const reshapedInput = reshape(\n {inputs: {x: sumInput}, attrs: {shape: [batchSize, inSize]},
backend});\n\n const outType = sumOutType(x.dtype);\n\n const reduced = reduce(reshapedInput, outType, 'sum',
backend);\n const out =\n reshape({inputs: {x: reduced}, attrs: {shape: outShape}, backend});\n\n
backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n if
(sumInputIsTransposed) {\n backend.disposeIntermediateTensorInfo(sumInput);\n } \n\n return out;\n\n\n"/**\n
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2.0 (the
 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
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*/\n\nimport {KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {sumImpl} from './Sum_impl';\n\nexport function
sum(\n args: {inputs: SumInputs, attrs: SumAttrs, backend: MathBackendWebGL}) {\n const {inputs, backend,
attrs} = args;\n\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n return sumImpl(x,
axis, keepDims, backend);\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n
backendName: 'webgl',\n kernelFunc: sum as {} as KernelFunc;\n};\n\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n
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*/\n\nimport {backend_util, TensorInfo, upcastType, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL}\n
from '../backend_webgl';\n\nimport {mapActivationToShaderProgram} from
../kernel_utils/kernel_funcs_utils';\n\nimport {MatMulPackedProgram} from './mulmat_packed_gpu';\n\nimport
{multiply} from './Multiply';\n\nimport {reshape} from './Reshape';\n\nimport {sum} from './Sum';\n\nimport {transpose}
from './Transpose';\n\n// Empirically determined minimal shared dimension in matmul before we forward\n// to
a.mul(b).sum() in order to take advantage of GPU parallelism. See\n// https://github.com/tensorflow/tfjs-
core/pull/1379 for benchmarks.\n\nexport const MATMUL_SHARED_DIM_THRESHOLD = 1000;\n\ninterface\nBatchMatMulConfig = {\n a: TensorInfo,\n b: TensorInfo,\n transposeA: boolean,\n transposeB: boolean,\n
backend: MathBackendWebGL,\n bias?: TensorInfo,\n preluActivationWeights?: TensorInfo,\n leakyreluAlpha?:
number,\n activation?: backend_util.Activation;\n};\n\nexport function batchMatMulImpl({\n a,\n b,\n
transposeA,\n transposeB,\n backend,\n bias = null,\n preluActivationWeights

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= null,\n leakyreluAlpha = 0,\n activation = null\n}: BatchMatMulConfig): TensorInfo {\n const aRank =
a.shape.length;\n const bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] :
a.shape[aRank - 1];\n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const
outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ?
b.shape[bRank - 2] : b.shape[bRank - 1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB =
b.shape.slice(0, -2);\n\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB =
util.sizeFromShape(outerDimsB);\n\n const batchDimsCompatible =\n batchDimA === batchDimB ||
batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 &&
batchDimsCompatible,\n () => `Error in matMul: the input batch dimensions must either be the ` +\n `same
or at least one input batch dimension must be 1. Got
input ` +\n `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims
=\n batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and (` +\n ` ${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n ` ${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape: [number, number, number] = transposeA ?\n [batchDimA, innerShapeA,
outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape: [number, number, number] =
transposeB ?\n [batchDimB, outerShapeB, innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n //
The rest of the implementation is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a},
backend,
attrs: {shape: a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const
intermediates: TensorInfo[] = [a3d, b3d];\n\n const batchDim = Math.max(batchDimA, batchDimB);\n const
sharedDim = transposeA ? a3d.shape[1] : a3d.shape[2];\n\n const hasBias = bias != null;\n const
hasPreluActivationWeights = preluActivationWeights != null;\n const hasLeakyreluAlpha = activation ===
'leakyrelu';\n const fusedActivation = activation != null ?\n mapActivationToShaderProgram(activation, true) :\n null;\n const containsFusedOps = hasBias || hasPreluActivationWeights ||\n hasLeakyreluAlpha ||
fusedActivation != null;\n let out: TensorInfo;\n\n // Since the matrices are vectors, it is faster to call mul().sum()\n
// because sum() is O(sqrt(N)) due to divide-and-conquer.\n if ((outerShapeA === 1 || outerShapeB === 1) &&\n
sharedDim > MATMUL_SHARED_DIM_THRESHOLD && containsFusedOps === false) {\n let aVec = a3d;\n let bVec
= b3d;\n if (transposeA) {\n aVec = transpose({inputs: {x: a3d}, backend, attrs: {perm: [0, 2, 1]}});\n
intermediates.push(aVec);\n }\n if (transposeB) {\n bVec = transpose({inputs: {x: b3d}, backend, attrs:
{perm: [0, 2, 1]}});\n intermediates.push(bVec);\n }\n\n const shouldReshapeA = outerShapeB !== 1;\n
const shouldReshapeB = outerShapeB === 1;\n\n let aVec3d = aVec;\n if (shouldReshapeA) {\n aVec3d =
reshape({\n inputs: {x: aVec},\n backend,\n attrs: {shape: [batchDim, sharedDim, 1]}\n });\n\n
intermediates.push(aVec3d);\n }\n\n const axis = outerShapeB === 1 ? 2 : 1;\n let bVec3d = bVec;\n if
(shouldReshapeB) {\n bVec3d = reshape({\n inputs: {x: bVec},\n backend,\n attrs: {shape:
[batchDim, 1, sharedDim]}\n });\n\n intermediates.push(bVec3d);\n }\n\n const product =
multiply({inputs: {a: aVec3d, b: bVec3d}, backend});\n out = sum({inputs: {x:
product}, backend, attrs: {axis, keepDims: true}});\n intermediates.push(product);\n } else {\n const dtype =
upcastType(a.dtype, b.dtype);\n\n const program = new MatMulPackedProgram(\n a3dShape, b3dShape,
[batchDim, outerShapeA, outerShapeB], transposeA,\n transposeB, hasBias, fusedActivation,
hasPreluActivationWeights,\n hasLeakyreluAlpha);\n\n const inputs: TensorInfo[] = [a3d, b3d];\n if (bias !=
null) {\n inputs.push(bias);\n }\n if (hasPreluActivationWeights) {\n
inputs.push(reluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha =
backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32',
'float32'));\n inputs.push($leakyreluAlpha);\n intermediates.push($leakyreluAlpha);\n }\n\n out =
backend.runWebGLProgram(program, inputs, dtype);\n }\n\n const outReshaped =\n reshape({inputs: {x: out},

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backend, attrs: { shape:
 outShape });\n intermediates.push(out);\n for (const i of intermediates) {\n
backend.disposeIntermediateTensorInfo(i);\n }\n return outReshaped;\n}\n", "/*\n * @license\n * Copyright 2020
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {batchMatMulImpl} from
'./BatchMatMul_impl';\n\nexport function _fusedMatMul(args: {\n inputs: _FusedMatMulInputs,\n attrs:
_FusedMatMulAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b,
bias, preluActivationWeights} = inputs;\n const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;\n\n
return batchMatMulImpl({\n a,\n b,\n transposeA,\n transposeB,\n backend,\n bias,\n
preluActivationWeights,\n leakyreluAlpha,\n activation\n });\n}\n\nexport const _fusedMatMulConfig:
KernelConfig = {\n kernelName: _FusedMatMul,\n backendName: 'webgl',\n kernelFunc: _fusedMatMul as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Acos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst ACOS =
CHECK_NAN_SNIPPET + \n\n if (abs(x) > 1.)\n\n return NAN;\n\n }\n\n return acos(x);\n\n};\n\nexport const acos =
unaryKernelFunc({opSnippet: ACOS});\n\nexport const acosConfig: KernelConfig = {\n kernelName: Acos,\n
backendName: 'webgl',\n kernelFunc: acos,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Acosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst ACOSH =
CHECK_NAN_SNIPPET + \n\n if (x < 1.0) return NAN;\n\nreturn log(x + sqrt(x * x - 1.0));\n\n};\n\nexport const acosh =
unaryKernelFunc({opSnippet:
ACOSH});\n\nexport const acoshConfig: KernelConfig = {\n kernelName: Acosh,\n backendName: 'webgl',\n
kernelFunc: acosh,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class AddNProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape:\n\n number[] = [];\n userCode: string;\n\n constructor(outputShape: number[], shapes: number[][]) {\n this.outputShape = outputShape;\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const snippets:\n\n string[] = [];\n // Get target elements from every input tensor.\n this.variableNames.forEach(variable => {\n snippets.push(`float v${variable} = get${variable}AtOutCoords();`);\n });\n\n // Calculate the sum of all\n elements.\n const operation = this.variableNames\n\n .map(variable => {\n return\n `v${variable}`;\n })\n\n .join(' + ');\n\n this.userCode = `\n void main() {\n ${snippets.join("\n ")}\n float result = ${operation};\n setOutput(result);\n }\n `;\n}\n\n", "/\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *
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\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class AddNPackedProgram implements\n GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n packedInputs =\n true;\n packedOutput = true;\n\n constructor(outputShape: number[], shapes: number[][]) {\n this.outputShape =\n outputShape;\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const snippets: string[]\n\n = [];\n // Get target elements from every input tensor.\n this.variableNames.forEach(variable => {\n snippets.push(`vec4 v${variable} = get${variable}AtOutCoords();`);\n });\n\n // Calculate the sum of all\n elements.\n const operation = this.variableNames\n\n .map(variable => {\n return\n `v${variable}`;\n })\n\n .join(' + ');\n\n this.userCode = `\n void main() {\n ${snippets.join("\n ")}\n vec4 result = ${operation};\n setOutput(result);\n }\n `;\n}\n\n", "/\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required\n by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language\n governing permissions and\n * limitations under the License.\n *
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*\n\nimport { AddN, AddNInputs, env, KernelConfig, KernelFunc, TensorInfo, upcastType } from\n '@tensorflow/tfjs-core';\n\nimport { AddNProgram } from './addn_gpu';\nimport { AddNPackedProgram } from\n './addn_packed_gpu';\nimport { MathBackendWebGL } from './backend_webgl';\nimport { identity } from\n './Identity';\n\nexport function addN(args: { inputs: AddNInputs, backend: MathBackendWebGL }):\n TensorInfo {\n const { inputs, backend } = args;\n\n const tensors = inputs;\n if (tensors.length === 1) {\n return\n identity({ inputs: { x: tensors[0] }, backend });\n }\n\n // Limit the number of uploaded textures for optimization.\n if\n (tensors.length > env().get('WEBGL_MAX_TEXTURES_IN_SHADER'))\n\n {\n const midIndex = Math.floor(tensors.length / 2);\n const leftSide = addN({ inputs: tensors.slice(0,\n midIndex), backend });\n const rightSide = addN({ inputs: tensors.slice(midIndex), backend });\n return\n addN({ inputs: [leftSide, rightSide], backend });\n }\n\n const dtype =\n tensors.map(t => t.dtype).reduce((d1,
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d2) => upcastType(d1, d2));\n const shapes = tensors.map(t => t.shape);\n // We can make sure shapes are identical
in op level.\n const usePackedOp = env().getBool('WEBGL_PACK');\n const program = usePackedOp ?\n new
AddNPackedProgram(tensors[0].shape, shapes) :\n new AddNProgram(tensors[0].shape, shapes);\n return
backend.runWebGLProgram(program, tensors, dtype);\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'webgl',\n kernelFunc: addN as {} as KernelFunc\n};\n", "/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,
Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { reduce } from
'./kernel_utils/reduce';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nexport
function all(\n args: {inputs: AllInputs, backend: MathBackendWebGL,\n attrs: AllAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
keepDims} = attrs;\n\n const xRank = x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n
let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX =
x;\n if (permutedAxes != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm:
permutedAxes}});\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('all', axes, xRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =
util.sizeFromShape(reduceShape);\n\n const a2D =\n reshape({inputs: {x: permutedX}, backend, attrs: {shape:
[-1, inSize]}});\n const reduced = reduce(a2D, a2D.dtype, 'all', backend);\n\n let res;\n if (keepDims) {\n const
newShape = backend_util.expandShapeToKeepDim(outShape,\n origAxes);\n res = reshape({inputs: {x: reduced}, backend, attrs: {shape: newShape}});\n } else {\n res =
reshape({inputs: {x: reduced}, backend, attrs: {shape: outShape}});\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n backend.disposeIntermediateTensorInfo(reduced);\n\n if
(permutedAxes != null) {\n backend.disposeIntermediateTensorInfo(permutedX);\n }\n\n return res;\n }\n\nexport
const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'webgl',\n kernelFunc: all as {} as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { reduce } from
'./kernel_utils/reduce';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nexport
function any(\n args: {inputs: AnyInputs, backend: MathBackendWebGL, attrs: AnyAttrs});\n TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n const xRank =
x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n
if (permutedAxes != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n
axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n

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backend_util.assertAxesAreInnerMostDims('any', axes, xRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =\n
util.sizeFromShape(reduceShape);\n\n const a2D =\n reshape({inputs: {x: permutedX}, backend, attrs: {shape:\n
[-1, inSize]});\n const reduced = reduce(a2D, a2D.dtype, 'any', backend);\n\n let res;\n if (keepDims) {\n const\n
newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n res = reshape({inputs: {x: reduced},\n
backend, attrs: {shape: newShape}});\n } else {\n res = reshape({inputs: {x: reduced}, backend, attrs: {shape:\n
outShape}});\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n
backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes != null) {\n
backend.disposeIntermediateTensorInfo(permutedX);\n
 }\n\n return res;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName:\n
'webgl',\n kernelFunc: any as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All\n
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n */\n
=====\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n
'./gpgpu_math';\n\nexport\n
class ArgMinMaxProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n reduceInfo: backend_util.ReduceInfo, op: 'max'|'min',\n firstPass:\n
boolean) {\n const {windowSize, batchSize, outSize} = reduceInfo;\n if (!firstPass) {\n\n
this.variableNames.push('bestIndicesA');\n }\n this.outputShape = [batchSize, outSize];\n const compOp = (op\n
=== 'max') ? '>' : '<';\n const indexSnippet = firstPass ?\n 'inOffset + i;'\n : 'round(getBestIndicesA(batch,\n
inOffset + i));'\n this.userCode =`\n void main() {\n ivec2 coords = getOutputCoords();\n int batch\n
= coords[0];\n int outIdx = coords[1];\n int inOffset = outIdx * ${windowSize};\n\n int bestIndex =\n
inOffset;\n float bestValue = getA(batch, bestIndex);\n\n for (int i = 0; i < ${windowSize}; i++) {\n\n
int inIdx = ${indexSnippet};\n\n float candidate = getA(batch, inIdx);\n if (candidate ${compOp} bestValue) {\n bestValue =\n
candidate;\n bestIndex = inIdx;\n }\n }\n setOutput(float(bestIndex));\n }\n `;\n
}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n
may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required\n
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n
License for the specific language governing permissions and\n * limitations under the License.\n */\n
=====\n
*/\n\nimport {util} from '@tensorflow/tfjs-core';\n\nimport\n
{GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport\n
{getCoordsDataType} from './shader_compiler';\n\nexport class ArgMinMaxPackedProgram implements\n
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs =\n
true;\n packedOutput = true;\n\n constructor(\n shape: number[], windowSize: number, op: 'max'|'min',\n firstPass: boolean) {\n util.assert(\n shape.length > 2,\n () => `Packed arg${\n
\n op.charAt(0).toUpperCase() +\n op.slice(1)} supports only inputs with rank above 2.`);\n const inSize =\n
shape[shape.length - 1];\n const outSize = Math.ceil(inSize / windowSize);\n this.outputShape = shape.slice(0, -\n
1);\n if (outSize > 1) {\n this.outputShape.push(outSize);\n }\n if (!firstPass) {\n\n
this.variableNames.push('bestIndicesA');\n }\n const outShape = this.outputShape;\n const rank =

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outShape.length;\n
const dtype = getCoordsDataType(rank);\n const coords = getChannels('coords', rank);\n let
sourceLocSetup;\n let sourceRank;\n if (outSize === 1) {\n sourceRank = rank + 1;\n const
sourceLocDType = getCoordsDataType(sourceRank);\n sourceLocSetup = `
 ${sourceLocDType}
sourceLocR = ${sourceLocDType}(${coords.join()}), 0);\n ++${coords[rank - 1]};\n ${sourceLocDType}
sourceLocG = ${sourceLocDType}(${coords.join()}), 0);\n ++${coords[rank - 2]};\n ${sourceLocDType}
sourceLocA = ${sourceLocDType}(${coords.join()}), 0);\n --${coords[rank - 1]};\n ${sourceLocDType}
sourceLocB = ${sourceLocDType}(${coords.join()}), 0);\n --${coords[rank - 2]}`;\n } else {\n
sourceRank = rank;\n sourceLocSetup = `
 ${dtype} sourceLocR = coords;\n ++${coords[rank - 1]};\n
 ${dtype} sourceLocG = coords;\n ++${coords[rank - 2]};\n ${dtype} sourceLocA = coords;\n --
 ${coords[rank
- 1]};\n ${dtype} sourceLocB = coords;\n --${coords[rank - 2]}`;\n }
const channels = ['x', 'y', 'z',
'w', 'u', 'v'].slice(0, sourceRank);\n const inChannel = '.' + channels[sourceRank - 1]; // e.g. ".b" for rank 3.\n
const intChannels = channels.map(x => 'int ' + x);\n const srcRCoords =\n getChannels('sourceLocR',
sourceRank - 1).concat('inIdx.r');\n const srcGCoords =\n getChannels('sourceLocG', sourceRank -
1).concat('inIdx.g');\n const srcBCoords =\n getChannels('sourceLocB', sourceRank - 1).concat('inIdx.b');\n
const srcACoords =\n getChannels('sourceLocA', sourceRank - 1).concat('inIdx.a');\n const compOp = (op
=== 'max') ? 'greaterThan' : 'lessThan';\n const fetchCandidateIdx = firstPass ? " : "\n inIdx =
round(vec4(getBestIndicesAChannel(${srcRCoords.join()}),\n
getBestIndicesAChannel(${srcGCoords.join()}),\n
getBestIndicesAChannel(${srcBCoords.join()}),\n
getBestIndicesAChannel(${srcACoords.join()})));\n const fetchValue = `vec4(\n
getAChannel(${srcRCoords.join()}),\n hasNextCol ? getAChannel(${srcGCoords.join()}): 0.,\n
hasNextRow ? getAChannel(${srcBCoords.join()}): 0.,\n hasNextRow && hasNextCol ?
getAChannel(${srcACoords.join()}): 0.`;\n const getBestIndicesAChannelSnippet = firstPass ? " : "\n float
getBestIndicesAChannel(${intChannels.join()}) {\n return getChannel(getBestIndicesA(${channels.join()}),\n
vec2(${channels.slice(-2).join()}));\n };\n this.userCode = `
float
getAChannel(${intChannels.join()}) {\n return getChannel(getA(${channels.join()}),\n
vec2(${channels.slice(-2).join()}));\n }\n ${getBestIndicesAChannelSnippet}\n void main() {\n
${dtype} coords = getOutputCoords();\n
bool hasNextCol = ${coords[rank - 1]} < ${outShape[rank - 1] - 1};\n bool hasNextRow = ${coords[rank -
2]} < ${outShape[rank - 2] - 1};\n ${sourceLocSetup}\n ivec4 srcIdx = ivec4(sourceLocR${inChannel},
sourceLocG${inChannel},\n sourceLocB${inChannel}, sourceLocA${inChannel}) * ${windowSize};\n
ivec4 inIdx = srcIdx;\n vec4 bestIndex = vec4(inIdx);\n vec4 bestValue = ${fetchValue};\n for (int i
= 0; i < ${windowSize}; i++) {\n inIdx = srcIdx;\n ${fetchCandidateIdx}\n vec4 candidate =
${fetchValue};\n bvec4 nan = isnan(candidate);\n bvec4 replace = bvec4(\n
vec4(${compOp}(candidate, bestValue)) * (vec4(1.0) - vec4(nan)));\n bestValue = vec4(replace.x ?
candidate.x : bestValue.x,\n replace.y ? candidate.y : bestValue.y,\n replace.z ?
candidate.z : bestValue.z,\n replace.w ? candidate.w
: bestValue.w);\n bestIndex = mix(bestIndex, vec4(inIdx), vec4(replace));\n srcIdx++;\n }\n
setOutput(bestIndex);\n }\n `;\n }\n }\n\n", /*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport {backend_util, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {ArgMinMaxProgram}
from './argminmax_gpu';\nimport {ArgMinMaxPackedProgram} from './argminmax_packed_gpu';\nimport
{MathBackendWebGL} from './backend_webgl';\nimport {reshape} from './kernels/Reshape';\n\nfunction
argReduce(\n backend: MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min',\n bestIndicesA:
TensorInfo = null): TensorInfo {\n let batchSize = x.shape[0];\n let inSize = x.shape[1];\n if (bestIndicesA != null)
{\n batchSize = bestIndicesA.shape[0];\n inSize = bestIndicesA.shape[1];\n }\n const windowSize =
backend_util.computeOptimalWindowSize(inSize);\n const reduceInfo =\n { windowSize, inSize, batchSize,
outSize: Math.ceil(inSize / windowSize)};\n const program =\n new ArgMinMaxProgram(reduceInfo,
reduceType, bestIndicesA == null);\n const inputs = [x];\n if (bestIndicesA != null) {\n
inputs.push(bestIndicesA);\n }\n const output = backend.runWebGLProgram(program, inputs, 'int32');\n // No
need to run another GPGPU program.\n if (output.shape[1]
=== 1) {\n return output;\n }\n const result = argReduce(backend, x, reduceType, output);\n
backend.disposeIntermediateTensorInfo(output);\n return result;\n}\n\nfunction argReducePacked(\n backend:
MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min',\n bestIndicesA: TensorInfo = null): TensorInfo {\n
const inShape = bestIndicesA != null ? bestIndicesA.shape : x.shape;\n const inSize = inShape[inShape.length -
1];\n const windowSize = backend_util.computeOptimalWindowSize(inSize);\n const program = new
ArgMinMaxPackedProgram(\n inShape, windowSize, reduceType, bestIndicesA == null);\n const inputs =
bestIndicesA == null ? [x] : [x, bestIndicesA];\n const output = backend.runWebGLProgram(program, inputs,
'int32');\n if (output.shape.length === x.shape.length) {\n const result = argReducePacked(backend, x,
reduceType, output);\n backend.disposeIntermediateTensorInfo(output);\n return result;\n }\n return
output;\n}\n\nexport function
argMinMaxReduce(\n backend: MathBackendWebGL, x: TensorInfo, axis: number,\n reduceType: 'min'|'max'):
TensorInfo {\n const axes = [axis];\n backend_util.assertAxesAreInnerMostDims(\n 'arg' +
reduceType.charAt(0).toUpperCase() + reduceType.slice(1), axes,\n x.shape.length);\n if
(!env().getBool('WEBGL_PACK_REDUCE') || x.shape.length <= 2) {\n const intermediateTensorInfos = [];\n
const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(x.shape, axes);\n const inSize
= util.sizeFromShape(reduceShape);\n const a2D = reshape({inputs: {x}, backend, attrs: {shape: [-1, inSize]}});\n
intermediateTensorInfos.push(a2D);\n\n const reduced = argReduce(backend, a2D, reduceType);\n
intermediateTensorInfos.push(reduced);\n const reshaped =\n reshape({inputs: {x: reduced}, backend, attrs:
{shape: outShape}});\n\n intermediateTensorInfos.forEach(\n t =>
backend.disposeIntermediateTensorInfo(t);\n return reshaped;\n }
}\n return argReducePacked(backend, x, reduceType);\n}\n\n", "/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport
{argMinMaxReduce} from
'./kernel_utils/arg_min_max';\n\nimport {transpose} from './Transpose';\n\nexport function argMax(\n args:\n
{inputs: ArgMaxInputs, backend: MathBackendWebGL, attrs: ArgMaxAttrs});\n TensorInfo {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const {axis} = attrs;\n\n let axes = util.parseAxisParam(axis,
x.shape);\n const permutedAxes = backend_util.getAxesPermutation(axes, x.shape.length);\n let $x = x;\n const
intermediateTensorInfos = [];\n if (permutedAxes != null) {\n $x = transpose({inputs: {x}, backend, attrs: {perm:
permutedAxes}});\n intermediateTensorInfos.push($x);\n axes = backend_util.getInnerMostAxes(axes.length,

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$x.shape.length);\n } \n\n backend_util.assertAxesAreInnerMostDims('argMax', [axes[0]], $x.shape.length);\n
const out = argMinMaxReduce(backend, $x, axes[0], 'max');\n\n intermediateTensorInfos.forEach(\n t =>
backend.disposeIntermediateTensorInfo(t));\n return out;\n\n\nexport const argMaxConfig: KernelConfig
= {\n kernelName: ArgMax,\n backendName: 'webgl',\n kernelFunc: argMax as { } as KernelFunc\n};\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport { ArgMin, ArgMinAttrs, ArgMinInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util }
from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'../backend_webgl';\n\nimport { argMinMaxReduce } from '../kernel_utils/arg_min_max';\n\nimport { transpose } from
'./Transpose';\n\n\nexport function argMin(\n args:\n {inputs: ArgMinInputs, backend: MathBackendWebGL,
attrs: ArgMinAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis}
= attrs;\n\n let axes = util.parseAxisParam(axis, x.shape);\n const permutedAxes =
backend_util.getAxesPermutation(axes, x.shape.length);\n let $x = x;\n const intermediateTensorInfos = [];\n if
(permutedAxes != null) {\n $x = transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n
intermediateTensorInfos.push($x);\n axes = backend_util.getInnerMostAxes(axes.length, $x.shape.length);\n
}\n\n backend_util.assertAxesAreInnerMostDims('argMin', [axes[0]], $x.shape.length);\n\n const out =
argMinMaxReduce(backend, $x, axes[0], 'min');\n\n intermediateTensorInfos.forEach(\n t =>
backend.disposeIntermediateTensorInfo(t));\n
return out;\n\n\n\nexport const argMinConfig: KernelConfig = {\n kernelName: ArgMin,\n backendName:
'webgl',\n kernelFunc: argMin as { } as KernelFunc\n};\n"/**\n *
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport { Asin, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\n\nimport
{CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\n\nconst ASIN = CHECK_NAN_SNIPPET +`\n if (abs(x) >
1.) {\n return NAN;\n }`\n\n return asin(x);\n`;\n\n\nexport const asin = unaryKernelFunc({opSnippet:
ASIN});\n\n\nexport const asinConfig: KernelConfig = {\n kernelName: Asin,\n backendName: 'webgl',\n
kernelFunc: asin,\n};\n"/**\n *
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\n\nimport { Asinh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\n\nconst ASINH =
CHECK_NAN_SNIPPET +`\n return log(x + sqrt(x * x + 1.0));`\n`;\n\n\nexport const asinh =

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unaryKernelFunc({opSnippet: ASINH});\n\nexport const asinhConfig: KernelConfig = {\n kernelName: Asinh,\n backendName: 'webgl',\n kernelFunc: asinh,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS
```

```
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
```

```
\n*\n\nimport {Atan, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\nconst ATAN = CHECK_NAN_SNIPPET + \n \n return atan(x);\n};\n\nexport const atan = unaryKernelFunc({opSnippet: ATAN});\n\nexport const atanConfig: KernelConfig = {\n kernelName: Atan,\n backendName: 'webgl',\n kernelFunc: atan,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
```

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law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
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```
\n*\n\nimport {Atan2} from '@tensorflow/tfjs-core';\nimport {KernelConfig} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc, CHECK_NAN_SNIPPET_BINARY, CHECK_NAN_SNIPPET_BINARY_PACKED} from '../kernel_utils/kernel_funcs_utils';\nconst ATAN2 = CHECK_NAN_SNIPPET_BINARY + \n \n return atan(a, b);\n};\n\nconst ATAN2_PACKED = \n \n vec4 result = atan(a, b);\n vec4 isNaN = min(vec4(isnan(a)) + vec4(isnan(b)), vec4(1.0));\n \n +\n CHECK_NAN_SNIPPET_BINARY_PACKED + \n \n return result;\n};\n\nexport const atan2 =\n \n binaryKernelFunc({opSnippet: ATAN2, packedOpSnippet: ATAN2_PACKED});\n\nexport const atan2Config: KernelConfig = {\n kernelName: Atan2,\n backendName: 'webgl',\n kernelFunc: atan2,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
```

```
\n*\n\nimport {Atanh, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\nconst ATANH = CHECK_NAN_SNIPPET + \n \n if ((x < -1.0) || (x > 1.0)) return NAN;\n \n return (log(1.0 + x) - log(1.0 - x)) / 2.0;\n};\n\nexport const atanh = unaryKernelFunc({opSnippet: ATANH});\n\nexport const atanhConfig: KernelConfig = {\n kernelName: Atanh,\n backendName: 'webgl',\n kernelFunc: atanh,\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====
```

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=====\\n
*/\\n\\nimport {backend_util} from '@tensorflow/tfjs-core';\\nimport {GPGPUProgram} from
'./gpgpu_math';\\n\\nexport class Pool2DProgram implements GPGPUProgram {\\n variableNames = ['x'];\\n
outputShape: number[];\\n userCode: string;\\n\\n constructor(\\n convInfo: backend_util.Conv2DInfo, poolType:
'max'|'avg',\\n computePositions: boolean, flattenPositions = false,\\n includeBatchInIndex = false) {\\n if
(poolType === 'avg' && computePositions) {\\n throw new Error('Cannot compute positions for average
pool.');

```

```

int xR = xRCorner + wR;\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\nfor (int wC = 0; wC < ${filterWidthNearestVec4}; wC += 4) {\n int xC = xCCorner + wC *
${dilationWidth};\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch,
xR, xC + ${dilationWidth}, d),\n getValue(batch, xR, xC + 2 * ${dilationWidth}, d),\n getValue(batch, xR, xC + 3 * ${dilationWidth}, d)\n);\n\n ${updateSnippet}\n}\n\n int xC
= xCCorner + ${filterWidthNearestVec4};\n if (${filterWidthVec4Remainder} === 1) {\n vec4 values
= vec4(\n getValue(batch,
xR, xC, d),\n initializationValue,\n initializationValue,\n initializationValue\n);\n\n ${updateSnippet}\n } else if (${filterWidthVec4Remainder} === 2) {\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch, xR, xC + ${dilationWidth}, d),\n initializationValue,\n initializationValue\n);\n\n ${updateSnippet}\n } else if
(${filterWidthVec4Remainder} === 3) {\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch, xR, xC + ${dilationWidth}, d),\n getValue(batch, xR, xC + 2 * ${dilationWidth}, d),\n initializationValue\n);\n\n ${updateSnippet}\n }\n}\n\nsetOutput(${returnValue});\n}\n\n`;\n}\n}\n\n\nexport class Pool3DProgram implements GPGPUProgram {\n
variableNames = ['x'];\n
outputShape: number[];\n
userCode: string;\n
constructor(\n convInfo: backend_util.Conv3DInfo, poolType:
'max'|'avg',\n computePositions: boolean, flattenPositions = false,\n includeBatchInIndex = false) {\n if
(poolType === 'avg' && computePositions) {\n throw new Error('Cannot compute positions for average
pool.);\n }\n\n const filterWidth = convInfo.filterWidth;\n const strideDepth = convInfo.strideDepth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationDepth =
convInfo.dilationDepth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const effectiveFilterDepth = convInfo.effectiveFilterDepth;\n const
effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const effectiveFilterWidth =
convInfo.effectiveFilterWidth;\n\n const padFront = convInfo.padInfo.front;\n const padTop =
convInfo.padInfo.top;\n const padLeft
= convInfo.padInfo.left;\n this.outputShape = convInfo.outShape;\n\n const isAvgPool = poolType ===
'avg';\n\n let initializationValue = '0.0';\n if (!isAvgPool) {\n // WebGL on Firefox Linux can't compile 1/0 so
we do 1/eps.\n initializationValue = '-1.0 / 1e-20';\n }\n\n if (computePositions) {\n const compareOp =
'>=';\n\n this.userCode = `\n const ivec3 strides =\n ivec3(${strideDepth}, ${strideHeight},
${strideWidth});\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n\n void main() {\n
 ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int ch = coords.u;\n\n ivec3 xCorner
= ivec3(coords.y, coords.z, coords.w) * strides - pads;\n int xDCorner = xCorner.x;\n int xRCorner =
xCorner.y;\n int xCCorner = xCorner.z;\n\n // max/min x(?, ?, ?, ch) to get y(yD, yR, yC, ch).\n // ?
= to be determined\n float
minMaxValue = 0.0;\n float minMaxValueFound = 0.0;\n int minMaxPosition = 0;\n\n for (int wD = 0; wD < ${effectiveFilterDepth};\n wD += ${dilationDepth}) {\n int xD = xDCorner + wD;\n\n if (xD < 0 || xD >= ${convInfo.inDepth}) {\n continue;\n }\n\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n int xR = xRCorner + wR;\n\n if
(xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n for (int wC = 0; wC <
${effectiveFilterWidth};\n wC += ${dilationWidth}) {\n int xC = xCCorner + wC;\n\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n\n float value =
getX(batch, xD, xR, xC, ch);\n\n // If a min / max value has already been found, use it. If not,\n
 // use the current value.\n float currMinMaxValue = mix(\n value, minMaxValue,
minMaxValueFound);\n\n if (value ${compareOp} currMinMaxValue) {\n minMaxValue =
value;\n minMaxValueFound = 1.0;\n minMaxPosition = ${\n flattenPositions ?\n
(includeBatchInIndex ?\n `(((batch * ${convInfo.inDepth} + xD) * ${\n
convInfo.inHeight} + xR) * ${convInfo.inWidth} + xC) * ${\n
convInfo.inChannels} + ch` :\n

```



```

./Identity';\n\nexport function avgPool(args: {\n inputs: AvgPoolInputs,\n backend: MathBackendWebGL,\n attrs: AvgPoolAttrs\n}): TensorInfo
{\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n assertNotComplex(x, 'avgPool');\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const dilations = 1;\n\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => 'Error in avgPool: Either strides or
dilations must be 1. ' +\n `Got strides ${strides} and dilations '${dilations}'`);\n\n const convInfo =
backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize, strides,\n
dilations, pad, dimRoundingMode);\n if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1 &&\n
util.arraysEqual(convInfo.inShape, convInfo.outShape)) {\n return identity({inputs: {x}, backend});\n }\n const
avgPoolProgram = new Pool2DProgram(convInfo, 'avg', false);\n return
backend.runWebGLProgram(avgPoolProgram, [x], 'float32');\n}\n\nexport const avgPoolConfig: KernelConfig =
{\n kernelName: AvgPool,\n backendName:
'webgl',\n kernelFunc: avgPool as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs, backend_util, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Pool3DProgram}
from './pool_gpu';\n\nexport function avgPool3D(args: {\n inputs: AvgPool3DInputs,\n backend:
MathBackendWebGL,\n attrs: AvgPool3DAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {filterSize, strides, pad, dimRoundingMode, dataFormat} = attrs;\n const dilations: [number,
number, number] = [1, 1, 1];\n\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number,
number, number, number, number], filterSize, strides,\n dilations, pad, dimRoundingMode, dataFormat);\n const
avgPoolProgram = new Pool3DProgram(convInfo, 'avg', false);\n return
backend.runWebGLProgram(avgPoolProgram, [x], 'float32');\n}\n\nexport const avgPool3DConfig: KernelConfig =
{\n kernelName: AvgPool3D,\n backendName: 'webgl',\n kernelFunc: avgPool3D as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class AvgPool2DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n
this.outputShape = convInfo.inShape;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterHeight =
convInfo.effectiveFilterHeight;\n const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n const padTop
= effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft = effectiveFilterWidth - 1 -

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convInfo.padInfo.left;\n\n const avgMultiplier = 1 / (filterHeight * filterWidth);\n\n this.userCode = `\n const
ivec2 pads = ivec2(${padTop}, ${padLeft});\n const float avgMultiplier = float(${avgMultiplier});\n\n void
main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n\n ivec2
dyRCCorner = coords.yz - pads;\n int dyRCorner = dyRCCorner.x;\n int dyCCorner = dyRCCorner.y;\n\n
 // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n
 // ? = to be determined. := across all values in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n\n for (int wC = 0; wC < ${effectiveFilterWidth};\n
wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n\n if (dyC < 0.0
|| dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC
= int(dyC);\n\n float dyValue = getDy(b, idyR, idyC, d);\n\n dotProd += dyValue * avgMultiplier;\n
 }\n }\n setOutput(dotProd);\n }\n `;\n}\n}\n\nexport class AvgPool3DBackpropProgram
implements GPGPUProgram
{\n variableNames = ['dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.inShape;\n const filterDepth =
convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const strideDepth = convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterDepth =
convInfo.effectiveFilterDepth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padFront = effectiveFilterDepth - 1 -
convInfo.padInfo.front;\n const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft =
effectiveFilterWidth
- 1 - convInfo.padInfo.left;\n\n const avgMultiplier = 1 / (filterDepth * filterHeight * filterWidth);\n\n
this.userCode = `\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n const float
avgMultiplier = float(${avgMultiplier});\n\n void main() {\n ivec5 coords = getOutputCoords();\n int
batch = coords.x;\n int ch = coords.u;\n ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w) - pads;\n
 int dyDCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int dyCCorner = dyCorner.z;\n\n //
Convolve dy(?, ?, ?, d) with pos mask(:, :, :, ch) to get\n // dx(xD, xR, xC, ch).\n // ? = to be determined. :=
across all values in that axis.\n float dotProd = 0.0;\n\n for (int wD = 0; wD < ${effectiveFilterDepth};\n
wD += ${dilationDepth}) {\n float dyD = float(dyDCorner + wD) / ${strideDepth}.0;\n\n if (dyD <
0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD)
> 0.0) {\n continue;\n }\n int idyD = int(dyD);\n\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||\n fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n\n for (int wC = 0; wC < ${effectiveFilterWidth};\n
wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n\n if
(dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n
 int idyC = int(dyC);\n\n float dyValue = getDy(batch, idyD, idyR, idyC, ch);\n\n dotProd +=
dyValue * avgMultiplier;\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n
}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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*\nimport { AvgPool3DGrad, AvgPool3DGradAttrs, AvgPool3DGradInputs, backend_util, KernelConfig,
KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { AvgPool3DBackpropProgram } from
'./avg_pool_backprop_gpu';\nimport { MathBackendWebGL } from './backend_webgl';\n\nexport
function avgPool3DGrad(args: {\n inputs: AvgPool3DGradInputs,\n backend: MathBackendWebGL,\n attrs:
AvgPool3DGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {dy, input} = inputs;\n
const x = input;\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const dilations: [number, number,
number] = [1, 1, 1];\n\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number, number,
number, number, number], filterSize, strides,\n dilations, pad, dimRoundingMode);\n const
avgPoolBackpropProgram = new AvgPool3DBackpropProgram(convInfo);\n return
backend.runWebGLProgram(avgPoolBackpropProgram, [dy], x.dtype);\n}\n\nexport const avgPoolGrad3DConfig:
KernelConfig = {\n kernelName: AvgPool3DGrad,\n backendName: 'webgl',\n kernelFunc: avgPool3DGrad as {}
as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport { AvgPoolGrad, AvgPoolGradAttrs, AvgPoolGradInputs, backend_util, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { AvgPool2DBackpropProgram } from
'./avg_pool_backprop_gpu';\nimport { MathBackendWebGL } from './backend_webgl';\nimport
{assertNotComplex } from './webgl_util';\n\nexport function avgPoolGrad(args: {\n inputs: AvgPoolGradInputs,\n
backend: MathBackendWebGL,\n attrs:
AvgPoolGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {dy, input} = inputs;\n
const x = input;\n assertNotComplex([dy, input], 'avgPoolGrad');\n const {filterSize, strides, pad} = attrs;\n\n
const convInfo = backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize,
strides,\n 1 /* dilations */, pad);\n const avgPoolBackpropProgram = new
AvgPool2DBackpropProgram(convInfo);\n return backend.runWebGLProgram(avgPoolBackpropProgram, [dy],
x.dtype);\n}\n\nexport const avgPoolGradConfig: KernelConfig = {\n kernelName: AvgPoolGrad,\n
backendName: 'webgl',\n kernelFunc: avgPoolGrad as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\nimport { batchMatMulImpl }
from './BatchMatMul_impl';\n\nexport function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n attrs:
BatchMatMulAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b}
= inputs;\n const {transposeA, transposeB} = attrs;\n\n return batchMatMulImpl({a, b, transposeA, transposeB,
backend});\n}\n\nexport const batchMatMulConfig: KernelConfig
= {\n kernelName: BatchMatMul,\n backendName: 'webgl',\n kernelFunc: batchMatMul as {} as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the

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License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class BatchNormProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n xShape: number[],\n meanShape: number[],\n varianceShape: number[],\n offsetShape: number[]|null,\n scaleShape: number[]|null,\n varianceEpsilon: number) {\n this.variableNames = ['x', 'mean', 'variance'];\n backend_util.assertAndGetBroadcastShape(xShape, meanShape);\n backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n let offsetSnippet = '0.0';\n if (offsetShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n this.variableNames.push('offset');\n offsetSnippet = 'getOffsetAtOutCoords()';\n }\n\n let scaleSnippet = '1.0';\n if (scaleShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n this.variableNames.push('scale');\n scaleSnippet = 'getScaleAtOutCoords()';\n }\n\n this.outputShape = xShape;\n this.userCode =`\n void main() {\n float\n x = getXAtOutCoords();\n float mean = getMeanAtOutCoords();\n float variance =\n getVarianceAtOutCoords();\n float offset = ${offsetSnippet};\n float scale = ${scaleSnippet};\n float\n inv = scale * inversesqrt(variance + float(${varianceEpsilon}));\n setOutput(dot(vec3(x, -mean, offset),\n vec3(inv, inv, 1)));\n }\n `;\n }\n}\n\n**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class BatchNormPackedProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(\n xShape: number[],\n meanShape: number[],\n varianceShape: number[],\n offsetShape: number[]|null,\n scaleShape: number[]|null,\n varianceEpsilon: number) {\n this.variableNames = ['x', 'mean', 'variance'];\n backend_util.assertAndGetBroadcastShape(xShape, meanShape);\n backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n let offsetSnippet = 'vec4(0.0)';\n if (offsetShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n this.variableNames.push('offset');\n offsetSnippet = 'getOffsetAtOutCoords()';\n }\n\n let scaleSnippet = 'vec4(1.0)';\n if (scaleShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n this.variableNames.push('scale');\n scaleSnippet = 'getScaleAtOutCoords()';\n }\n\n this.outputShape = xShape;\n this.userCode =`\n void\n main() {\n vec4 offset = ${offsetSnippet};\n vec4 scale = ${scaleSnippet};\n\n vec4 x =\n getXAtOutCoords();\n vec4 mean = getMeanAtOutCoords();\n vec4 variance =\n getVarianceAtOutCoords();\n\n vec4 inv = scale * inversesqrt(variance + vec4(${varianceEpsilon}));\n setOutput((x - mean) * inv + offset);\n }\n `;\n }\n}\n\n**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
```



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```
=====
import {env, FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core'; import {MathBackendWebGL} from '../backend_webgl'; import
{BatchNormProgram} from '../batchnorm_gpu'; import {BatchNormPackedProgram} from
'../batchnorm_packed_gpu';
export const batchNorm: (params: {inputs: FusedBatchNormInputs, backend:
MathBackendWebGL, attrs: FusedBatchNormAttrs}) => TensorInfo = ({inputs, backend, attrs}) => {const
{x, mean, variance, offset, scale} = inputs;
util.assert(mean.shape.length
=== variance.shape.length, () => 'Batch normalization gradient requires mean and variance to have ' +
'equal ranks. ');
util.assert(offset == null || mean.shape.length === offset.shape.length, () => 'Batch
normalization gradient requires mean and offset to have ' +
'equal ranks. ');
util.assert(scale == null ||
mean.shape.length === scale.shape.length, () => 'Batch normalization gradient requires mean and scale to have
' +
'equal ranks. ');
let {varianceEpsilon} = attrs;
if (varianceEpsilon == null) {varianceEpsilon =
0.001;}
const finalInputs = [x, mean, variance];
let offsetShape = null;
if (offset != null) {offsetShape = offset.shape;
finalInputs.push(offset);}
let scaleShape = null;
if (scale != null) {scaleShape = scale.shape;
finalInputs.push(scale);}
const program =
env().getBool('WEBGL_PACK_NORMALIZATION') ?
new BatchNormPackedProgram(x.shape, mean.shape, variance.shape, offsetShape, scaleShape, varianceEpsilon) :
new BatchNormProgram(x.shape, mean.shape, variance.shape, offsetShape, scaleShape, varianceEpsilon);
const output = backend.runWebGLProgram(program, finalInputs, finalInputs[0].dtype);
return output;}
export const batchNormConfig: KernelConfig = {kernelName:
FusedBatchNorm, backendName: 'webgl', kernelFunc: batchNorm as KernelFunc};
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```

```
=====
import {GPGPUContext} from './gpgpu_context'; import {GPGPUProgram} from './gpgpu_math'; import
{getCoordsDataType} from './shader_compiler';
export class SliceProgram implements GPGPUProgram {variableNames = ['source'];
outputShape: number[];
userCode: string;
rank: number;
// Caching uniform location for speed.
startLoc: WebGLUniformLocation;
constructor(destSize: number[]) {this.outputShape = destSize;
this.rank = destSize.length;
const dtype = getCoordsDataType(this.rank);
const uniformPart = `uniform int start[${this.rank}];`;
const sourceCoords = getCoords(this.rank);
let body: string;
const coordSum = destSize.map((_, i) => {return `sourceLoc.${coords[i]}
= start[${i}] + coords[${coords[i]}];`});
body = `
${dtype} sourceLoc;
${dtype} coords =
getOutputCoords();
${coordSum.join('\n')}
`;
this.userCode = `
${uniformPart}
void
main() {
${body}
setOutput(getSource(${sourceCoords}));
}
`;
}
getCustomSetupFunc(start: number[]) {if (start.length !== this.rank) {throw Error(`The rank
(${this.rank}) of the program must match the ` +
`length of start (${start.length})`);}
return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {if (this.startLoc == null) {this.startLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');}
if (this.startLoc == null) {// This means
the compiler has optimized and realized it doesn't need
// the uniform.
return;}
}
```

```

gpgpu.gl.uniform1iv(this.startLoc, start);\n };\n }\n\nconst
coords = ['x', 'y', 'z', 'w', 'u', 'v'];\n\nfunction getCoords(rank: number): string {\n if (rank === 1) {\n return
'sourceLoc';\n } else if (rank <= 6) {\n return coords.slice(0, rank).map(x => 'sourceLoc.' + x).join(',');\n } else
{\n throw Error(`Slicing for rank ${rank} is not yet supported`);\n }\n}\n\n"/**\n * @license\n * Copyright 2019
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n
*/\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class
SlicePackedProgram implements GPGPUProgram {\n variableNames = ['source'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n rank: number;\n\n // Caching uniform
location for speed.\n startLoc: WebGLUniformLocation;\n\n constructor(destSize: number[]) {\n
this.outputShape = destSize;\n this.rank = destSize.length;\n\n const dtype = getCoordsDataType(this.rank);\n
const coords = getChannels('coords', this.rank);\n const sourceLoc = getChannels('sourceLoc', this.rank);\n\n
const innerDims =\n this.rank === 1 ? 'sourceLoc' : `vec2(${sourceLoc.slice(-2).join()})`; \n const getChannel
=\n `getChannel(getSource(${sourceLoc.join()}), ${innerDims})`; \n
const upperRow = `\n result.x = ${getChannel};\n if (++${coords[this.rank - 1]} < ${destSize[this.rank -
1]}) {\n ++${sourceLoc[this.rank - 1]};\n result.y = ${getChannel};\n --${sourceLoc[this.rank - 1]};\n
 }\n `;\n const lowerRow = this.rank === 1 ? " : "\n --${coords[this.rank - 1]};\n if (++${coords[this.rank
- 2]} < ${destSize[this.rank - 2]}) {\n ++${sourceLoc[this.rank - 2]};\n result.z = ${getChannel};\n if
(++${coords[this.rank - 1]} < ${destSize[this.rank - 1]}) {\n ++${sourceLoc[this.rank - 1]};\n result.w =
${getChannel};\n }\n `;\n\n const sourceLocSetup = this.rank <= 4 ?\n `sourceLoc = coords +\n
 ${dtype}(${destSize.map((_, i) => `start[${i}]`).join()})`; \n destSize.map((_, i) => `${sourceLoc[i]} =
 ${coords[i]} + start[${i}];`)\n .join("\n");\n this.userCode = `\n uniform int start[${this.rank}];\n void
main() {\n ${dtype} coords = getOutputCoords();\n ${dtype} sourceLoc;\n ${sourceLocSetup}\n
 vec4 result = vec4(0.); \n ${upperRow}\n ${lowerRow}\n setOutput(result);\n }\n `;\n }\n\n
getCustomSetupFunc(start: number[]) {\n if (start.length !== this.rank) {\n throw Error(`The rank
(${this.rank}) of the program must match the ` +\n `length of start (${start.length})`);\n }\n return (gpgpu:
GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.startLoc == null) {\n this.startLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');\n if (this.startLoc == null) {\n // This means
the compiler has optimized and realized it doesn't need\n // the uniform.\n return;\n }\n }\n
gpgpu.gl.uniform1iv(this.startLoc, start);\n };\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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=====*\n
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from
'./Transpose';\n\nexport const batchToSpaceND = (args: {\n inputs:

```

```

BatchToSpaceNDInputs,\n backend: MathBackendWebGL,\n attrs: BatchToSpaceNDAttrs\n}): TensorInfo => {\n
const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n\n util.assert(\n
x.shape.length <= 4,\n () => 'batchToSpaceND for rank > 4 with a WebGL backend not '+\n 'implemented\n
yet');\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped = backend_util.getReshaped(x.shape,\n
blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const\n
reshapedPermuted =\n backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const\n
sliceBeginCoords =\n backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const toDispose = [];\n\n const\n
reshapedIntermediate =\n reshape({inputs: {x}, backend, attrs: {shape: reshaped}});\n const\n
transposedIntermediate\n
= transpose(\n {inputs: {x: reshapedIntermediate}, backend, attrs: {perm: permuted}});\n const\n
reshapedIntermediate2 = reshape({\n inputs: {x: transposedIntermediate},\n backend,\n attrs: {shape:\n
reshapedPermuted}\n });\n const sliced = slice({\n inputs: {x: reshapedIntermediate2},\n backend,\n attrs:\n
{begin: sliceBeginCoords, size: sliceSize}\n });\n\n toDispose.push(reshapedIntermediate);\n
toDispose.push(transposedIntermediate);\n toDispose.push(reshapedIntermediate2);\n\n toDispose.forEach(t =>\n
backend.disposeIntermediateTensorInfo(t));\n\n return sliced;\n};\n\nexport const batchToSpaceNDConfig:\n
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'webgl',\n kernelFunc: batchToSpaceND as\n
{ } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Bincount, BincountAttrs, BincountInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray} from\n
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {bincountImplCPU}\n
from './kernel_utils/shared';\n\nexport function bincount(args: {\n inputs: BincountInputs,\n backend:\n
MathBackendWebGL,\n attrs: BincountAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x,\n
weights} = inputs;\n const {size} = attrs;\n\n const xVals =\n
backend.readSync(x.dataId) as TypedArray;\n const weightsVals = backend.readSync(weights.dataId) as\n
TypedArray;\n\n const outVals =\n bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape,\n
size);\n\n return backend.makeTensorInfo([size], weights.dtype, outVals);\n}\n\nexport const bincountConfig:\n
KernelConfig = {\n kernelName: Bincount,\n backendName: 'webgl',\n kernelFunc: bincount as { } as\n
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n
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=====\n
*/\n\nimport {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from\n
'./backend_webgl';\n\nimport {UnaryOpProgram} from './unaryop_gpu';\n\nconst TO_INT = `return\n
float(int(x));`\n\nexport function int(input: TensorInfo, backend: MathBackendWebGL): TensorInfo {\n const\n
program = new UnaryOpProgram(input.shape, TO_INT);\n const output = backend.runWebGLProgram(program,\n
[input], 'int32');\n return {dataId: output.dataId, shape: output.shape, dtype: output.dtype};\n}\n\n"/**\n * @license\n
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```
=====
*
import {GPGPUContext} from './gpgpu_context';
import {GPGPUProgram} from './gpgpu_math';
export
class ClipProgram implements GPGPUProgram {
 variableNames = ['A'];
 userCode: string;
 outputShape:
 number[];
 // Caching uniform locations for speed.
 minLoc: WebGLUniformLocation;
 maxLoc:
 WebGLUniformLocation;
 constructor(aShape: number[]) {
 this.outputShape = aShape;
 this.userCode =`
 uniform float minVal;
 uniform float maxVal;
 void main() {
 float value =
 getAAAtOutCoords();
 if (isnan(value)) {
 setOutput(value);
 return;
 }
 setOutput(clamp(value, minVal, maxVal));
 }
 }
 getCustomSetupFunc(min: number,
max: number) {
 return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {
 if (this.minLoc
== null) {
 this.minLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');
 this.maxLoc
= gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');
 }
 gpgpu.gl.uniform1f(this.minLoc,
min);
 gpgpu.gl.uniform1f(this.maxLoc, max);
 };
 }
}
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```
=====
*
import {GPGPUContext} from './gpgpu_context';
import {GPGPUProgram} from './gpgpu_math';
export
class ClipPackedProgram implements GPGPUProgram {
 variableNames = ['A'];
 packedInputs = true;
 packedOutput = true;
 userCode: string;
 outputShape: number[];
 // Caching uniform locations for speed.
 minLoc: WebGLUniformLocation;
 maxLoc: WebGLUniformLocation;
 constructor(aShape: number[]) {
 this.outputShape = aShape;
 this.userCode =`
 uniform float minVal;
 uniform float maxVal;
 void
 main() {
 vec4 value = getAAAtOutCoords();
 if (any(isnan(value))) {
 setOutput(value);
 return;
 }
 setOutput(clamp(value, vec4(minVal), vec4(maxVal)));
 }
 }
 getCustomSetupFunc(min: number, max: number) {
 return (gpgpu: GPGPUContext,
webGLProgram: WebGLProgram) => {
 if (this.minLoc == null) {
 this.minLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');
 this.maxLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');
 }
 gpgpu.gl.uniform1f(this.minLoc,
min);
 gpgpu.gl.uniform1f(this.maxLoc, max);
 };
 }
}
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```

```
=====
*
import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, env, KernelConfig, KernelFunc, TensorInfo}
from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {ClipProgram}
from './clip_gpu';
import {ClipPackedProgram} from './clip_packed_gpu';
export function clipByValue(args:
```

```

{\n inputs: ClipByValueInputs,\n backend: MathBackendWebGL,\n attrs: ClipByValueAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n\n let
program;\n if (env().getBool('WEBGL_PACK_CLIP')) {\n program = new ClipPackedProgram(x.shape);\n }
else {\n program = new ClipProgram(x.shape);\n }\n\n const customSetup =
program.getCustomSetupFunc(clipValueMin, clipValueMax);\n return backend.runWebGLProgram(program,
[x], x.dtype, customSetup);\n}\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName:
ClipByValue,\n backendName: 'webgl',\n kernelFunc: clipByValue as {} as KernelFunc\n};\n",/**\n * @license\n
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the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ComplexAbsProgram implements
GPGPUProgram {\n variableNames = ['real', 'imag'];\n userCode: string;\n outputShape: number[];\n\n
constructor(shape: number[]) {\n this.outputShape = shape;\n this.userCode = `\n void main() {\n float re
= abs(getRealAtOutCoords());\n float im = abs(getImagAtOutCoords());\n float mx = max(re, im);\n\n
// sadly the length function in glsl is not underflow-safe\n // (at least not on Intel GPUs). So the safe solution
is\n // to ensure underflow-safety in all cases.\n setOutput(\n mx == 0.0 ? 0.0 : mx * length(vec2(1,
min(re, im)/mx))\n);\n }\n `;\n }\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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=====\n
*\n\nimport {ComplexAbs, ComplexAbsInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ComplexAbsProgram} from
'./complex_abs_gpu';\n\n// Returns a TensorInfo with the complex shape and the dataId of the\n// underlying part.
We need to do this because a reshaped complex tensor is\n// not reflected in its parts.\n\nfunction
makeComplexComponentTensorInfo(\n complexTensor: TensorInfo, complexPart: TensorInfo): TensorInfo {\n
return {\n dataId: complexPart.dataId,\n dtype: complexPart.dtype,\n shape: complexTensor.shape\n
};\n}\n\nexport function complexAbs(\n args: {inputs: ComplexAbsInputs, backend: MathBackendWebGL}):
TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n const xData =
backend.texData.get(x.dataId);\n\n const program = new ComplexAbsProgram(x.shape);\n const programInputs =
[\n makeComplexComponentTensorInfo(x, xData.complexTensorInfos.real),\n
makeComplexComponentTensorInfo(x, xData.complexTensorInfos.imag),\n];\n\n return
backend.runWebGLProgram(\n program, programInputs, programInputs[0].dtype);\n}\n\nexport const
complexAbsConfig: KernelConfig = {\n kernelName: ComplexAbs,\n backendName: 'webgl',\n kernelFunc:
complexAbs as {} as KernelFunc\n};\n",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n
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the License.\n \*

```
=====\n\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n'./gpgpu_math';\n\nexport class ConcatProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n\n // Concat 2d tensors along axis=1. See comments in\n MathBackendWebGL.concat().\n constructor(shapes: Array<number, number>) {\n this.outputShape =\n backend_util.computeOutShape(shapes, 1 /* axis */);\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const offsets: number[] = new Array(shapes.length - 1);\n\n offsets[0] = shapes[0][1];\n for (let i = 1; i < offsets.length; i++) {\n offsets[i] = offsets[i - 1] + shapes[i][1];\n }\n\n const snippets = [\n `if (yC < ${offsets[0]}) setOutput(getT0(yR, yC));`,\n `for (let i = 1; i < offsets.length;\n i++) {\n const shift = offsets[i - 1];\n snippets.push(\n `else if (yC < ${offsets[i]}) ` +\n `setOutput(getT${i}(yR, yC-${shift}));`\n);\n }\n `const lastIndex = offsets.length;\n const lastShift =\n offsets[offsets.length - 1];\n snippets.push(`else setOutput(getT${lastIndex}(yR, yC-${lastShift}));`);\n];\n\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n int yR = coords.x;\n int yC\n = coords.y;\n\n ${snippets.join("\n ")}\n }\n `;\n }\n\n /**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance\n * with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-\n * 2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */\n}
```

```
=====\n\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n'./gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from\n'./shader_compiler';\n\nexport class ConcatPackedProgram implements GPGPUProgram {\n variableNames:\n string[];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[] = [];\n userCode: string;\n\n constructor(shapes: number[][], axis: number) {\n this.outputShape =\n backend_util.computeOutShape(shapes, axis);\n const shape = this.outputShape;\n const rank = shape.length;\n const dtype = getCoordsDataType(rank);\n const coords = getChannels('coords', rank);\n const channels = ['x',\n 'y', 'z', 'w', 'u', 'v'].slice(0, rank);\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const offsets:\n number[] = new Array(shapes.length - 1);\n offsets[0] = shapes[0][axis];\n for (let i = 1; i < offsets.length; i++)\n {\n offsets[i] = offsets[i - 1] + shapes[i][axis];\n }\n\n const channel = channels[axis];\n const lastChannels\n = channels.slice(-2);\n const allChannels = channels.join();\n\n let getValueSnippet = `if (${channel} <\n ${offsets[0]}) {\n return getChannel(\n getT0(${allChannels}),\n vec2(${lastChannels.join()}));\n }`;\n\n for (let i = 1; i < offsets.length; i++) {\n const shift = offsets[i - 1];\n // Note: the >= comparison below\n may seem unnecessary given the check\n // above but is needed to workaround branch execution issues on some\n // devices. It makes all the\n conditions exclusive without relying on\n // execution order.\n getValueSnippet += `\n if (${channel} <\n ${offsets[i]} && ${channel} >= ${offsets[i - 1]}) {\n return getChannel(\n getT${i}(${shiftedChannels(channels, channel, shift)}),\n vec2(${shiftedChannels(lastChannels, channel,\n shift)}));\n `;\n }\n }\n\n const lastIndex = offsets.length;\n const shift = offsets[offsets.length - 1];\n getValueSnippet += `\n return getChannel(\n getT${lastIndex}(${shiftedChannels(channels, channel,\n shift)}),\n vec2(${shiftedChannels(lastChannels, channel, shift)}));`\n\n this.userCode = `\n float\n getValue(${channels.map(x => 'int ' + x)}) {\n ${getValueSnippet}\n }\n\n void main() {\n ${dtype}\n coords = getOutputCoords();\n vec4 result = vec4(getValue(${coords}), 0.,\n 0., 0.); \n ${coords[rank - 1]} = ${coords[rank - 1]} + 1;\n if (${coords[rank - 1]} < ${shape[rank - 1]})\n {\n result.g = getValue(${coords});\n }\n ${coords[rank - 2]} = ${coords[rank - 2]} + 1;\n if`
```

```

({ coords[rank - 2] < ${shape[rank - 2]}) {\n result.a = getValue(${ coords});\n }\n\n ${ coords[rank
- 1]} = ${ coords[rank - 1]} - 1;\n if (${ coords[rank - 2] < ${shape[rank - 2]} &&\n ${ coords[rank - 1]}
< ${shape[rank - 1]}) {\n result.b = getValue(${ coords});\n }\n setOutput(result);\n }\n `;\n
}\n}\n\n/**\n * Return an expression for coordinates into a vector where a given channel\n * will be offset by
[shift].\n *\n * @param channels the channels to consider\n * @param channel the channel we want shifted\n *
@param shift the amount to subtract from the channel.\n *\n * @returns a string of the form 'x, y-[shift], z' where
any one channel can\n * have the shift
applied.\n */\nfunction shiftedChannels(channels: string[], channel: string, shift: number) {\n const channelId =
channels.indexOf(channel);\n const res = channels.map((c, idx) => {\n if (idx === channelId) {\n return
`${c} - ${shift}`;\n } else {\n return c;\n }\n });\n return res.join();\n}\n\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport { Imag, ImagInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport
{ MathBackendWebGL } from '../backend_webgl';\n\nimport { identity } from './Identity';\n\nexport function imag(args:
{ inputs: ImagInputs, backend: MathBackendWebGL }):\n TensorInfo {\n const { inputs, backend } = args;\n const
{ input } = inputs;\n const inputData = backend.texData.get(input.dataId);\n\n return identity({ inputs: { x:
inputData.complexTensorInfos.imag }, backend });\n}\n\nexport const imagConfig: KernelConfig = {\n
kernelName: Imag,\n backendName: 'webgl',\n kernelFunc: imag as { } as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, TensorInfo, util } from
 '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport { concatImpl } from
 './Concat_impl';\n\nimport { identity } from './Identity';\n\nexport function concat(\n args:\n { inputs:
ConcatInputs, attrs: ConcatAttrs, backend: MathBackendWebGL }):\n TensorInfo {\n const { inputs, backend,
attrs } = args;\n const { axis } = attrs;\n\n const $axis = util.parseAxisParam(axis, inputs[0].shape)[0];\n const
outShape =\n backend_util.computeOutShape(inputs.map(t
=> t.shape), $axis);\n\n if (util.sizeFromShape(outShape) === 0) {\n return backend.makeTensorInfo(outShape,
inputs[0].dtype, []);\n }\n\n // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n const $inputs
= inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return identity({ inputs: { x:
$inputs[0] }, backend });\n }\n\n const shapes = $inputs.map(t => t.shape);\n\n backend_util.assertParamsConsistent(shapes, $axis);\n return concatImpl($inputs, $axis, backend);\n}\n\nexport
const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'webgl',\n kernelFunc: concat as
{ } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n */

```

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```
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
 './gpgpu_math';\n\nexport class Conv2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n constructor(\n convInfo: backend_util.Conv2DInfo, addBias =
 false,\n activation: string = null, hasPreluActivationWeights = false,\n hasLeakyreluAlpha = false) {\n this.outputShape = convInfo.outShape;\n const padTop = convInfo.padInfo.top;\n const padLeft =
 convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
 dilationWidth = convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
 convInfo.filterWidth;\n const inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n const
 inputDepthVec4Remainder = convInfo.inChannels % 4;\n const isChannelsLast = convInfo.dataFormat ===
 'channelsLast';\n const rowDim = isChannelsLast ? 1 : 2;\n const colDim = isChannelsLast ? 2 : 3;\n const
 channelDim = isChannelsLast ? 3 : 1;\n let activationSnippet = "", applyActivationSnippet = "";
 if (activation)
 {\n if (hasPreluActivationWeights) {\n activationSnippet = `float activation(float a) {\n float b =
 getPreluActivationWeightsAtOutCoords();\n ${activation}\n }`; \n } else if (hasLeakyreluAlpha) {\n activationSnippet = `float activation(float a) {\n float b = getLeakyreluAlphaAtOutCoords();\n ${activation}\n }`; \n } else {\n activationSnippet = `float activation(float x) {\n float b =
 ${activation}\n }`; \n } \n applyActivationSnippet = `result = activation(result);`;\n } \n\nconst addBiasSnippet = addBias ? 'result += getBiasAtOutCoords();' : "";\nif (addBias) {\n this.variableNames.push('bias');\n} \n\nif (hasPreluActivationWeights) {\n this.variableNames.push('preluActivationWeights');\n} \n\nif (hasLeakyreluAlpha) {\n this.variableNames.push('leakyreluAlpha');\n} \n\nthis.userCode = `\n ${activationSnippet}\n const
 ivec2 strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n void main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d2 =
 coords[${channelDim}];\n ivec2 xRCCorner =\n ivec2(coords[${rowDim}],
 coords[${colDim}]) * strides - pads;\n int xRCorner = xRCCorner.x;\n int xCCorner = xRCCorner.y;\n // Convolve x(?, ?, d1) with w(:, :, d1, d2) to get y(yR, yC, d2).\n // ? = to be determined. : = across all values
 in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n int xR =
 xRCorner + wR * ${dilationHeight};\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC *
 ${dilationWidth};\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n }\n for (int d1 = 0; d1 < ${inputDepthNearestVec4}; d1 += 4) {\n vec4 wValues = vec4(\n getW(wR,
 wC, d1, d2),\n getW(wR, wC, d1 + 1, d2),\n getW(wR, wC, d1 + 2, d2),\n getW(wR,
 wC, d1 + 3, d2)\n);\n if (${isChannelsLast}) {\n vec4 xValues = vec4(\n getX(batch, xR, xC,
 d1),\n getX(batch, xR, xC, d1 + 1),\n getX(batch, xR, xC, d1 + 2),\n getX(batch, xR,
 xC, d1 + 3)\n);\n dotProd += dot(xValues, wValues);\n } else {\n vec4 xValues
 = vec4(\n getX(batch, d1, xR, xC),\n getX(batch, d1 + 1, xR, xC),\n getX(batch, d1
 + 2, xR, xC),\n getX(batch, d1 + 3, xR, xC)\n);\n dotProd += dot(xValues,
 wValues);\n }\n }\n if (${inputDepthVec4Remainder} === 1) {\n if
 (${isChannelsLast}) {\n dotProd +=\n getX(batch, xR, xC, ${inputDepthNearestVec4}) * \n getW(wR, wC, ${inputDepthNearestVec4}, d2);\n } else {\n dotProd +=\n getX(batch, ${inputDepthNearestVec4}, xR, xC) * \n getW(wR, wC,
 ${inputDepthNearestVec4}, d2);\n }\n } else if (${inputDepthVec4Remainder} === 2) {\n vec2 wValues = vec2(\n getW(wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wR, wC,
 ${inputDepthNearestVec4} + 1, d2)\n);\n if (${isChannelsLast}) {\n vec2 xValues =
 vec2(\n getX(batch, xR, xC, ${inputDepthNearestVec4}),\n getX(batch, xR, xC,
```



```

 ${inputDepthNearestVec4} + 1)\n);\n dotProd += dot(xValues, wValues);\n } else {\n vec2 xValues = vec2(\n getX(batch, ${inputDepthNearestVec4}, xR, xC),\n getX(batch,\n${inputDepthNearestVec4} + 1, xR, xC)\n);\n dotProd += dot(xValues, wValues);\n }\n }\n }\n if (\n ${inputDepthVec4Remainder} === 3) {\n vec3 wValues = vec3(\n getW(wR, wC,\n${inputDepthNearestVec4}, d2),\n getW(wR, wC, ${inputDepthNearestVec4} + 1, d2),\n getW(wR, wC, ${inputDepthNearestVec4} + 2, d2)\n);\n if (${isChannelsLast}) {\n vec3 xValues = vec3(\n getX(batch, xR, xC, ${inputDepthNearestVec4}),\n getX(batch, xR,\nxC, ${inputDepthNearestVec4} + 1),\n getX(batch, xR, xC, ${inputDepthNearestVec4} + 2)\n);\n dotProd += dot(xValues, wValues);\n } else {\n vec3 xValues = vec3(\n getX(batch, ${inputDepthNearestVec4}, xR, xC),\n getX(batch, ${inputDepthNearestVec4} + 1, xR,\nxC),\n getX(batch, ${inputDepthNearestVec4} + 2, xR, xC)\n);\n dotProd +=\ndot(xValues, wValues);\n }\n }\n }\n }\n float result = dotProd;\n ${addBiasSnippet}\n ${applyActivationSnippet}\n setOutput(result);\n }\n `;\n }\n}\n\nexport class Conv3DProgram\nimplements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv3DInfo) {\n this.outputShape = convInfo.outShape;\n const padFront =\nconvInfo.padInfo.front;\n const padTop = convInfo.padInfo.top;\n const padLeft = convInfo.padInfo.left;\n const strideDepth = convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\nconvInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight =\nconvInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const filterDepth =\nconvInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =\nconvInfo.filterWidth;\n const\n inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n const inputDepthVec4Remainder =\nconvInfo.inChannels % 4;\n this.userCode = `\n const ivec3 strides = ivec3(${strideDepth}, ${strideHeight},\n${\n strideWidth});\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n void main()\n {\n ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int d2 = coords.u;\n ivec3\nxFRCCorner = ivec3(coords.y, coords.z, coords.w) * strides - pads;\n int xFCorner = xFRCCorner.x;\n int\nxRCorner = xFRCCorner.y;\n int xCCorner = xFRCCorner.z;\n // Convolve x(?, ?, ?, d1) with w(:, :, :\nd1, d2) to get\n // y(yF, yR, yC, d2). ? = to be determined. := across all\n // values in that axis.\n float\ndotProd = 0.0;\n for (int wF = 0; wF < ${filterDepth}; wF++) {\n int xF = xFCorner + wF *\n${dilationDepth};\n if (xF < 0 || xF >= ${convInfo.inDepth})\n {\n continue;\n }\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n int xR = xRCorner\n+ wR * ${dilationHeight};\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC * ${dilationWidth};\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n for (int d1 = 0; d1 <\n${inputDepthNearestVec4}; d1 += 4) {\n vec4 xValues = vec4(\n getX(batch, xF, xR, xC, d1),\n getX(batch, xF, xR, xC, d1 + 1),\n getX(batch, xF, xR, xC, d1 + 2),\n getX(batch, xF,\nxR, xC, d1 + 3)\n);\n vec4 wValues = vec4(\n getW(wF, wR, wC, d1, d2),\n getW(wF, wR, wC, d1 + 1, d2),\n getW(wF, wR, wC, d1 + 2, d2),\n getW(wF, wR, wC, d1 + 3, d2)\n);\n dotProd += dot(xValues, wValues);\n }\n }\n if (${inputDepthVec4Remainder} === 1) {\n dotProd +=\n getX(batch, xF, xR,\nxC, ${inputDepthNearestVec4}) *\n getW(wF, wR, wC, ${inputDepthNearestVec4}, d2);\n }\n else if (${inputDepthVec4Remainder} === 2) {\n vec2 xValues = vec2(\n getX(batch, xF, xR,\nxC, ${inputDepthNearestVec4}),\n getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 1)\n);\n vec2 wValues = vec2(\n getW(wF, wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wF, wR, wC, ${inputDepthNearestVec4} + 1, d2)\n);\n dotProd += dot(xValues,\nwValues);\n } else if (${inputDepthVec4Remainder} === 3) {\n vec3 xValues = vec3(\n
```

```

getX(batch, xF,
 xR, xC, ${inputDepthNearestVec4}),\n
 getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 1),\n
 getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 2)\n
);\n
 vec3 wValues = vec3(\n
 getW(wF, wR, wC, ${inputDepthNearestVec4}, d2),\n
 getW(wF, wR, wC,
 ${inputDepthNearestVec4} + 1, d2),\n
 getW(wF, wR, wC, ${inputDepthNearestVec4} + 2, d2)\n
);\n
 dotProd += dot(xValues, wValues);\n
 }\n
 }\n
 }\n
 }\n
setOutput(dotProd);\n
}\n
};\n
}\n
}\n
}\n
}\n
"/**\n
 * @license\n
 * Copyright 2019 Google LLC. All Rights
Reserved.\n
 * Licensed under the Apache License, Version 2.0 (the "License");\n
 * you may not use this file
except in compliance with the License.\n
 * You may obtain a copy of the License at\n
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 * http://www.apache.org/licenses/LICENSE-2.0\n
 * Unless required by applicable law or agreed to in writing,
software\n
 * distributed under the License is distributed on an "AS IS" BASIS,\n
 * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language
governing permissions and\n
 * limitations under the License.\n
 *
=====
*\n
\n
import {backend_util} from '@tensorflow/tfjs-core';\n
import {getGlslDifferences} from
'./glsl_version';\n
import {GPGPUProgram} from './gpgpu_math';\n
\n
export class Im2ColPackedProgram
implements GPGPUProgram {\n
 variableNames = ['A'];\n
 packedInputs = true;\n
 packedOutput = true;\n
 outputShape: number[];\n
 userCode: string;\n
\n
 constructor(\n
 outputShape: number[], inputShape: number[],\n
 convInfo: backend_util.Conv2DInfo) {\n
 this.outputShape = outputShape;\n
\n
 const {\n
 filterWidth,\n
 inChannels,\n
 strideWidth,\n
 strideHeight,\n
 padInfo,\n
 outWidth,\n
 dilationWidth,\n
 dilationHeight,\n
 dataFormat\n
 } = convInfo;\n
 const {left, top} = padInfo;\n
 const itemsPerBlockRow =
inChannels * filterWidth;\n
 const glsl = getGlslDifferences();\n
 const isChannelsLast = dataFormat ===
'channelsLast';\n
 const rowDim = isChannelsLast ? 0 : 1;\n
 const colDim = isChannelsLast ? 1 : 2;\n
\n
 let
unrolled = ``;\n
 for (let row = 0; row <= 1; row++) {\n
 for (let col = 0; col <= 1; col++) {\n
 unrolled +=
`\n
 blockIndex = rc.y + ${col};\n
 pos = rc.x + ${row};\n
\n
 if(blockIndex < ${outputShape[1]} &&
pos < ${outputShape[0]}) {\n
 offsetY = int(blockIndex / (${outWidth})) * ${strideHeight} - ${\n
top};\n
 d0 = offsetY + ${dilationHeight} * (pos / ${itemsPerBlockRow});\n
\n
 if(d0 <
${inputShape[rowDim]} && d0 >= 0) {\n
\n
 offsetX = int(mod(float(blockIndex), ${outWidth}.) * ${\n
strideWidth}. - ${left}.);\n
 d1 = offsetX + ${dilationWidth}
\n
 * (int(mod(float(pos), ${\n
itemsPerBlockRow}.) / ${inChannels}.));\n
\n
 if(d1 <
${inputShape[colDim]} && d1 >= 0) {\n
\n
 ch = int(mod(float(pos), ${inChannels}.));\n
\n
 if
(${isChannelsLast}) {\n
 innerDims = vec2(d1, ch);\n
 result[${row * 2 + col}] = getChannel(\n
\n
 getA(d0, int(innerDims.x),\n
int(innerDims.y)), innerDims);\n
\n
 } else {\n
innerDims = vec2(d0, d1);\n
 result[${row * 2 + col}] = getChannel(\n
\n
 getA(ch,\n
int(innerDims.x),\n
int(innerDims.y)), innerDims);\n
\n
 }\n
\n
 }\n
\n
 }\n
\n
 }\n
\n
 }\n
\n
 }\n
\n
 }\n
\n
 this.userCode = `\n
 void main() {\n
 ivec2 rc = getOutputCoords();\n
\n
 vec4 result =
vec4(0);\n
\n
 int blockIndex, pos, offsetY, d0, offsetX, d1, ch;\n
 vec2 innerDims;\n
\n
 ${unrolled}\n
\n
 ${glsl.output} = result;\n
 }\n
 `;\n
}\n
}\n
}\n
}\n
}\n
"/**\n
 * @license\n
 * Copyright 2020 Google LLC. All Rights
Reserved.\n
 * Licensed under the Apache License, Version 2.0 (the "License");\n
 * you may not use this file
except in compliance with the License.\n
 * You may obtain a copy of the License at\n
 *
 * http://www.apache.org/licenses/LICENSE-2.0\n
 * Unless required by applicable law or agreed to in writing,
software\n
 * distributed under the License is distributed on an "AS IS" BASIS,\n
 * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language
governing permissions and\n
 * limitations under the License.\n
 *
=====
*\n
\n
import {backend_util, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n
import {MathBackendWebGL}
from './backend_webgl';\n
import {Im2ColPackedProgram} from './im2col_packed_gpu';\n
import
{mapActivationToShaderProgram}

```

```

from './kernel_utils/kernel_funcs_utils';\nimport { MatMulPackedProgram } from './mulmat_packed_gpu';\nimport
* as webgl_util from './webgl_util';\n\nimport { batchMatMulImpl, MATMUL_SHARED_DIM_THRESHOLD }
from './BatchMatMul_impl';\nimport { identity } from './Identity';\nimport { reshape } from './Reshape';\n\ntype
Conv2DConfig = {\n x: TensorInfo,\n filter: TensorInfo,\n convInfo: backend_util.Conv2DInfo,\n backend:
MathBackendWebGL,\n bias?: TensorInfo,\n preluActivationWeights?: TensorInfo,\n leakyreluAlpha?: number,\n
activation?: backend_util.Activation\n};\n\n// For 1x1 kernels that iterate through every point in the input,
convolution\n// can be expressed as matrix multiplication (without need for memory\n// remapping).\n\nexport
function conv2dByMatMul({\n x,\n filter,\n convInfo,\n backend,\n bias = null,\n preluActivationWeights =
null,\n leakyreluAlpha = 0,\n activation = null\n}: Conv2DConfig) {\n // Reshapes conv2D input to 2D tensors,
uses
 matMul and then reshape the\n // result from 2D to 4D.\n const xShape = x.shape;\n const xTexData =
backend.texData.get(x.dataId);\n const sharedMatMulDim = convInfo.inChannels;\n const outerShapeX =
xShape[0] * xShape[1] * xShape[2];\n const outerShapeFilter = convInfo.outChannels;\n const isChannelsLast =
convInfo.dataFormat === 'channelsLast';\n const transposeA = false;\n const transposeB = false;\n\n let out:
TensorInfo;\n const intermediates: TensorInfo[] = [];\n\n // TODO: Once reduction ops are packed, batchMatMul
will always be packed\n // and we can remove this condition.\n const batchMatMulWillBeUnpacked =\n (outerShapeX === 1 || outerShapeFilter === 1) &&\n sharedMatMulDim >
MATMUL_SHARED_DIM_THRESHOLD;\n const reshapeWillBeExpensive = xShape[2] % 2 !== 0 &&
!!xTexData.isPacked;\n\n if (batchMatMulWillBeUnpacked || !env().getBool('WEBGL_LAZILY_UNPACK') ||\n !env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ||\n !reshapeWillBeExpensive) {\n
 const targetShape = isChannelsLast ? xShape[0] * xShape[1] * xShape[2] :\n xShape[0]
* xShape[2] * xShape[3];\n const xReshaped = reshape({\n inputs: {x},\n backend,\n attrs: {shape: [1,
targetShape, convInfo.inChannels]}\n });\n const filterReshaped = reshape({\n inputs: {x: filter},\n
backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n const result =
batchMatMulImpl({\n a: xReshaped,\n b: filterReshaped,\n transposeA,\n transposeB,\n backend,\n
bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n out = reshape(\n {inputs:
{x: result}, backend, attrs: {shape: convInfo.outShape}});\n intermediates.push(xReshaped);\n
intermediates.push(filterReshaped);\n intermediates.push(result);\n } else {\n // Following optimization is
specific to packed |x| with odd row count\n // (For
 example, in channelLast mode, 'row count' refers to x.shape[2]):\n // we avoid expensive packed 2x2 reshape by
padding row count to next,\n // even number. When x.shape[2] is odd, the result of packed batchMatMul is\n //
the same (has the same texture layout and values in the texture) as\n // it is for even x.shape[2] + 1. We make
the odd-rows tensor to look like\n // even-rows tensor before the operation and, after the batchMatMul,\n // fix
the even-rows result to have odd number of rows.\n const targetShape = isChannelsLast ?\n xShape[0] *
xShape[1] * (xShape[2] + 1) :\n xShape[0] * xShape[2] * (xShape[3] + 1);\n const xReshaped: TensorInfo =
{\n dataId: x.dataId,\n shape: [1, targetShape, convInfo.inChannels],\n dtype: x.dtype\n };\n //
xTexData.shape gets referenced from GPGPUBinary.inShapeInfos.\n // Decrementing row count, after
batchMatMul->...->compileProgram leads to\n // invalid row count within the reference
in GPGPUBinary.inShapeInfos.\n // Alternative fix would be to provide a copy to GPGPUBinary.inShapeInfos\n
// in compileProgram method, but that would affect compilation of all\n // programs - instead, provide a copy here,
with even row count, before\n // calling batchMatMul->...->compileProgram and after that, the original\n //
xTexData.shape is restored.\n const originalXTexDataShape = xTexData.shape;\n xTexData.shape =
xTexData.shape.slice();\n xTexData.shape[xTexData.shape.length - 2]++;;\n util.assert(\n
webgl_util.isReshapeFree(xTexData.shape, xReshaped.shape),\n () => `packed reshape ${xTexData.shape} to
${\n xReshaped.shape\n } isn't free`);\n const filterReshaped = reshape({\n inputs: {x: filter},\n
backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n
intermediates.push(filterReshaped);\n const pointwiseConv = batchMatMulImpl({\n a: xReshaped,\n b:
filterReshaped,\n

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 backend,\n transposeA,\n transposeB,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n\n const pointwiseConvTexData = backend.texData.get(pointwiseConv.dataId);\n util.assert(\n pointwiseConvTexData.isPacked,\n () => 'batchMatMul result is expected to be packed');\n // Restore the input shape to original.\n xTexData.shape = originalXTexDataShape;\n // Set the output shape -\n there is no need for expensive reshape as data\n // layout is already correct.\n pointwiseConvTexData.shape =\n convInfo.outShape;\n\n out = identity({inputs: {x: pointwiseConv}, backend});\n out.shape =\n convInfo.outShape;\n\n intermediates.push(pointwiseConv);\n }\n\n for (const i of intermediates) {\n backend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n}\n\n// Implements the im2row algorithm as\n outlined in \"High Performance\n // Convolutional Neural Networks for Document Processing\" (Suvisoft,\n 2006)\nexport function conv2dWithIm2Row({\n x,\n filter,\n convInfo,\n backend,\n bias = null,\n preluActivationWeights = null,\n leakyreluAlpha = 0,\n activation = null\n}: Conv2DConfig) {\n // Rearranges\n conv2d input so each block to be convolved over forms the\n // column of a new matrix with shape [filterWidth *\n filterHeight *\n // inChannels, outHeight * outWidth]. The filter is also rearranged so each\n // output channel\n forms a row of a new matrix with shape [outChannels,\n // filterWidth * filterHeight * inChannels]. The\n convolution is then\n // computed by multiplying these matrices and reshaping the result.\n const {\n filterWidth,\n filterHeight,\n inChannels,\n outWidth,\n outHeight,\n dataFormat\n } = convInfo;\n\n const isChannelsLast = dataFormat === 'channelsLast';\n const sharedDim = filterWidth * filterHeight *\n inChannels;\n const numCols = outHeight * outWidth;\n const x2ColShape = [sharedDim, numCols];\n const\n transposeA\n = true;\n const transposeB = false;\n\n const intermediates: TensorInfo[] = [];\n\n const xSqueezed =\n reshape({inputs: {x}, backend, attrs: {shape: x.shape.slice(1)}});\n const w2Row = reshape({\n inputs: {x:\n filter},\n backend,\n attrs: {shape: [1, sharedDim, util.sizeFromShape(filter.shape) / sharedDim]}\n });\n\n intermediates.push(xSqueezed);\n intermediates.push(w2Row);\n\n const im2ColProgram =\n new\n Im2ColPackedProgram(x2ColShape, xSqueezed.shape, convInfo);\n const im2Col =\n backend.runWebGLProgram(im2ColProgram, [xSqueezed], 'float32');\n const im2ColReshaped = reshape({\n inputs: {x: im2Col},\n backend,\n attrs: {shape: [1, x2ColShape[0], x2ColShape[1]]}\n });\n\n intermediates.push(im2Col);\n intermediates.push(im2ColReshaped);\n\n const hasBias = bias != null;\n const\n hasPreluActivationWeights = preluActivationWeights != null;\n const\n hasLeakyreluAlpha = activation ===\n 'leakyrelu';\n const fusedActivation =\n activation ?\n mapActivationToShaderProgram(activation, true) : null;\n const matmulProgram = new MatMulPackedProgram(\n im2ColReshaped.shape as [number, number, number],\n w2Row.shape as [number, number, number],\n [1,\n numCols, convInfo.outChannels],\n transposeA, transposeB, hasBias,\n fusedActivation,\n hasPreluActivationWeights, hasLeakyreluAlpha);\n const inputs: TensorInfo[] = [im2ColReshaped, w2Row];\n if\n (bias) {\n inputs.push(bias);\n }\n if (hasPreluActivationWeights) {\n inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32', 'float32'));\n inputs.push($leakyreluAlpha);\n }\n intermediates.push($leakyreluAlpha);\n }\n const product = backend.runWebGLProgram(matmulProgram, inputs,\n 'float32');\n\n const outShape = isChannelsLast ?\n [1, outHeight, outWidth, convInfo.outChannels] :\n [1,\n convInfo.outChannels,\n outHeight, outWidth];\n const out =\n reshape({inputs: {x: product}, backend, attrs: {shape: outShape}});\n\n intermediates.push(product);\n for (const i of intermediates) {\n backend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n limitations under the\n License.\n */

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*\n\nimport
 {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, env, KernelConfig, KernelFunc, TensorInfo} from
 '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {Conv2DProgram}
 from './conv_gpu';\n\nimport {conv2dByMatMul, conv2dWithIm2Row} from './Conv2D_impl';\n\nimport {reshape}
 from './Reshape';\n\nexport function conv2d(\n args:\n {inputs: Conv2DInputs, attrs: Conv2DAttrs, backend:
 MathBackendWebGL}) {\n const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad,
 dataFormat, dilations, dimRoundingMode} = attrs;\n\n const $dataFormat =
 backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
 x.shape as [number, number, number, number],\n filter.shape as [number, number, number, number], strides,
 dilations, pad,\n dimRoundingMode, false /* depthwise */, $dataFormat);\n let out: TensorInfo;\n\n if
 (convInfo.filterHeight === 1 && convInfo.filterWidth ===
 1 &&\n convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&\n convInfo.strideHeight ===
 1 && convInfo.strideWidth === 1 &&\n (convInfo.padInfo.type === 'SAME' || convInfo.padInfo.type ===
 'VALID')) {\n out = conv2dByMatMul({x, filter, convInfo, backend});\n } else if
 (env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\n out = conv2dWithIm2Row({x, filter,
 convInfo, backend});\n } else {\n const program = new Conv2DProgram(convInfo);\n out =
 backend.runWebGLProgram(program, [x, filter], 'float32');\n }\n\n const outReshaped =\n reshape({inputs: {x:
 out}, backend, attrs: {shape: convInfo.outShape}});\n backend.disposeIntermediateTensorInfo(out);\n\n return
 outReshaped;\n}\n\nexport const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName:
 'webgl',\n kernelFunc: conv2d as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All
 Rights Reserved.\n * Licensed under the Apache License, Version
 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
 copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
 law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
 =====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
 './gpgpu_math';\n\nexport class Conv2DDerFilterProgram implements GPGPUProgram {\n variableNames = ['x',
 'dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n
 this.outputShape = convInfo.filterShape;\n\n const strideHeight = convInfo.strideHeight;\n
 const strideWidth = convInfo.strideWidth;\n const padTop = convInfo.padInfo.top;\n const padLeft =
 convInfo.padInfo.left;\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n\n this.userCode =
 `\n void main() {\n ivec4 coords = getOutputCoords();\n int wR = coords.x;\n int wC = coords.y;\n
 int d1 = coords.z;\n int d2 = coords.w;\n\n // Convolve x(?, ?, d1) with dy(:, :, d2) to get dw(wR, wC, d1,
 d2).\n // ? = to be determined. : = across all values in that axis.\n float dotProd = 0.0;\n for (int b = 0;
 b < ${convInfo.batchSize}; b++) {\n for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\n int xR =
 wR + yR * ${strideHeight} - ${padTop};\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n
 continue;\n }\n\n for (int yC = 0; yC < ${convInfo.outWidth}; yC++) {\n int xC = wC + yC *
 ${strideWidth} - ${padLeft};\n\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n
 }\n\n if
 (${isChannelsLast}) {\n float dyValue = getDy(b, yR, yC, d2);\n float xValue = getX(b, xR, xC,
 d1);\n dotProd += (xValue * dyValue);\n } else {\n float dyValue = getDy(b, d2, yR,
 yC);\n float xValue = getX(b, d1, xR, xC);\n dotProd += (xValue * dyValue);\n }\n
 }\n }\n }\n setOutput(dotProd);\n }\n `;\n}\n}\n\nexport class Conv2DDerInputProgram
 implements GPGPUProgram {\n variableNames = ['dy', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n
 this.outputShape = convInfo.inShape;\n\n const

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filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth
= convInfo.strideWidth;\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n\n const padTop =
filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth - 1 - convInfo.padInfo.left;\n\n const
rowDim = isChannelsLast ? 1 : 2;\n const colDim = isChannelsLast ? 2 : 3;\n const channelDim =
isChannelsLast ? 3 : 1;\n\n this.userCode = `\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void
main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d1 =
coords[${channelDim}];\n\n ivec2 dyCorner = ivec2(coords[${rowDim}], coords[${colDim}]) - pads;\n int
dyRCorner = dyCorner.x;\n int dyCCorner = dyCorner.y;\n\n // Convolve dy(?, ?, d2) with w(:, :, d1, d2) to
compute dx(xR, xC, d1).\n // ? = to be determined. := across all values in that axis.\n float dotProd = 0.0;\n
 for (int wR = 0; wR < ${filterHeight}; wR++) {\n float dyR = float(dyRCorner
+ wR) / ${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n\n int wRPerm = ${filterHeight} - 1 - wR;\n\n for (int
wC = 0; wC < ${filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n\n
if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n
int idyC = int(dyC);\n\n int wCPerm = ${filterWidth} - 1 - wC;\n\n for (int d2 = 0; d2 <
${convInfo.outChannels}; d2++) {\n\n if (${isChannelsLast}) {\n float xValue = getDy(batch,
idyR, idyC, d2);\n float wValue = getW(wRPerm, wCPerm, d1, d2);\n dotProd += xValue *
wValue;\n } else {\n float xValue = getDy(batch, d2, idyR, idyC);\n float wValue =
getW(wRPerm,
wCPerm, d1, d2);\n dotProd += xValue * wValue;\n }\n\n }\n }\n }\n }\n
setOutput(dotProd);\n }\n `;\n}\n\nexport class Conv3DDerFilterProgram implements GPGPUProgram {\n variableNames = ['x', 'dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.filterShape;\n\n const strideDepth =
convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const padFront = convInfo.padInfo.front;\n const padTop = convInfo.padInfo.top;\n
const padLeft = convInfo.padInfo.left;\n\n this.userCode = `\n void main() {\n ivec5 coords =
getOutputCoords();\n int wF = coords.x;\n int wR = coords.y;\n int wC = coords.z;\n int d1 =
coords.w;\n int d2 = coords.u;\n\n float dotProd = 0.0;\n\n for (int b = 0; b < ${convInfo.batchSize};
b++) {\n for (int yF = 0; yF < ${convInfo.outDepth}; yF++) {\n int xF = wF + yF * ${strideDepth} -
${padFront};\n\n if (xF < 0 || xF >= ${convInfo.inDepth}) {\n continue;\n }\n\n for (int
yR = 0; yR < ${convInfo.outHeight}; yR++) {\n int xR = wR + yR * ${strideHeight} - ${padTop};\n\n
 if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n for (int yC = 0; yC <
${convInfo.outWidth}; yC++) {\n int xC = wC + yC * ${strideWidth} - ${padLeft};\n\n if (xC <
0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n\n float dyValue = getDy(b, yF,
yR, yC, d2);\n float xValue = getX(b, xF, xR, xC, d1);\n dotProd += (xValue * dyValue);\n
 }\n }\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n}\n\nexport
class Conv3DDerInputProgram implements GPGPUProgram {\n variableNames = ['dy', 'W'];\n outputShape:
number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv3DInfo) {\n this.outputShape =
convInfo.inShape;\n\n const filterDepth = convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n
const filterWidth = convInfo.filterWidth;\n const strideDepth = convInfo.strideDepth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n\n const padFront = filterDepth - 1 -
convInfo.padInfo.front;\n const padTop = filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth -
1 - convInfo.padInfo.left;\n\n this.userCode = `\n const ivec3 pads = ivec3(${padFront}, ${padTop},
${padLeft});\n\n void main() {\n ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int d1
= coords.u;\n\n ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w)
- pads;\n int dyFCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int dyCCorner =
dyCorner.z;\n\n float dotProd = 0.0;\n for (int wF = 0; wF < ${filterDepth}; wF++) {\n float dyF =

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float(dyFCorner + wF) / ${strideDepth}.0;\n\n if (dyF < 0.0 || dyF >= ${convInfo.outDepth}.0 || fract(dyF) >
0.0) {\n continue;\n }\n int idyF = int(dyF);\n\n int wFPerm = ${filterDepth} - 1 - wF;\n\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||\n fract(dyR) > 0.0) {\n continue;\n }\n int idyR = int(dyR);\n\n int wRPerm = ${filterHeight} - 1 - wR;\n\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) /
${strideWidth}.0;\n\n if (dyC < 0.0 || dyC
>= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC =
int(dyC);\n\n int wCPerm = ${filterWidth} - 1 - wC;\n\n for (int d2 = 0; d2 <
${convInfo.outChannels}; d2++) {\n float xValue = getDy(batch, idyF, idyR, idyC, d2);\n float
wValue = getW(wFPerm, wRPerm, wCPerm, d1, d2);\n dotProd += xValue * wValue;\n }\n
}\n }\n setOutput(dotProd);\n }\n `;\n }\n }\n "\n "\n @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport {backend_util, Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs,
KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {Conv2DDerFilterProgram} from './conv_backprop_gpu';\n\nexport function
conv2DBackpropFilter(args: {\n inputs: Conv2DBackpropFilterInputs,\n attrs: Conv2DBackpropFilterAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, dy} = inputs;\n const
{strides, pad, dataFormat, dimRoundingMode, filterShape} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
 x.shape as [number, number, number, number], filterShape, strides,\n 1 /* dilations */, pad,
dimRoundingMode, false /* depthwise */,
 $dataFormat);\n\n const program = new
Conv2DDerFilterProgram(convInfo);\n return backend.runWebGLProgram(program, [x, dy],
'float32');\n}\n\nexport const conv2DBackpropFilterConfig: KernelConfig = {\n kernelName:
Conv2DBackpropFilter,\n backendName: 'webgl',\n kernelFunc: conv2DBackpropFilter as {} as
KernelFunc,\n};\n "\n "\n @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n

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* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {Conv2DDerInputProgram} from './conv_backprop_gpu';\n\nexport function
conv2DBackpropInput(args: {\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {dy, filter} = inputs;\n const
{inputShape, strides, pad, dataFormat, dimRoundingMode} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
 inputShape, filter.shape as [number, number, number, number], strides,\n 1 /* dilations

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*/, pad, dimRoundingMode, false, $dataFormat);\n\n const program = new Conv2DDerInputProgram(convInfo);\nreturn backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'webgl',\n kernelFunc: conv2DBackpropInput as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { backend_util, Conv3D, Conv3DAttrs, Conv3DInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\n\nimport { Conv3DProgram }
from './conv_gpu';\n\nexport function conv3D(\n args:\n {inputs: Conv3DInputs, attrs: Conv3DAttrs,\n
backend: MathBackendWebGL}) {\n const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const
{strides, pad, dilations} = attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n x.shape as [number,\n
number, number, number, number],\n filter.shape as [number, number, number, number, number], strides,\n
dilations, pad);\n\n const program = new Conv3DProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, filter], 'float32');\n}\n\nexport const conv3DConfig: KernelConfig = {\n
kernelName: Conv3D,\n backendName: 'webgl',\n kernelFunc: conv3D as { } as KernelFunc,\n};\n", "/*\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
* =====\n
*\n\nimport { backend_util, Conv3DBackpropFilterV2, Conv3DBackpropFilterV2Attrs,\n
Conv3DBackpropFilterV2Inputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport
{ MathBackendWebGL } from './backend_webgl';\n\nimport { Conv3DDerFilterProgram } from
'./conv_backprop_gpu';\n\nexport
function conv3DBackpropFilterV2(args: {\n inputs: Conv3DBackpropFilterV2Inputs,\n attrs:
Conv3DBackpropFilterV2Attrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n
const {x, dy} = inputs;\n const {strides, pad, filterShape} = attrs;\n\n const convInfo =
backend_util.computeConv3DInfo(\n x.shape as [number, number, number, number, number], filterShape,\n
strides,\n 1 /* dilations */, pad);\n\n const program = new Conv3DDerFilterProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, dy], 'float32');\n}\n\nexport const conv3DBackpropFilterV2Config:
KernelConfig = {\n kernelName: Conv3DBackpropFilterV2,\n backendName: 'webgl',\n kernelFunc:
conv3DBackpropFilterV2 as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
* =====\n
*\n\nimport { backend_util, Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs,\n
Conv3DBackpropInputV2Inputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport

```





```

 `y1*${inputHeightFloat} + float(y)*(height_scale)`,\n]:\n [\n '0.0',\n '0.0',\n `0.5 *
(y1+y2) * ${inputHeightFloat}`,\n];\n const [widthRatio, widthScale, inX] = cropWidth > 1 ?\n [\n `${(imageWidth - 1) / (cropWidth - 1)}`,\n '(x2-x1) * width_ratio',\n `x1*${inputWidthFloat} +
float(x)*(width_scale)`,\n]:\n [\n '0.0',\n '0.0',\n `0.5 * (x1+x2) * ${inputWidthFloat}`,\n
];\n\n // Reference
implementation\n // tslint:disable-next-line:max-line-length\n //
https://github.com/tensorflow/tensorflow/blob/master/tensorflow/core/kernels/crop_and_resize_op_gpu.cc\n
this.userCode = `\n const float height_ratio = float(${heightRatio});\n const float width_ratio =
float(${widthRatio});\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int
y = coords[1];\n int x = coords[2];\n int d = coords[3];\n\n // get box vals\n float y1 =
getBoxes(b,0);\n float x1 = getBoxes(b,1);\n float y2 = getBoxes(b,2);\n float x2 = getBoxes(b,3);\n\n
 // get image in batch index\n int bInd = round(getBoxInd(b));\n if(bInd < 0 || bInd >= ${batch}) {\n
return;\n }\n\n float height_scale = ${heightScale};\n float width_scale = ${widthScale};\n\n float
in_y = ${inY};\n if(in_y < 0.0 || in_y > ${inputHeightFloat}) {\n
 setOutput(float(${extrapolationValue}));\n return;\n }\n float in_x = ${inX};\n if(in_x < 0.0 ||
in_x > ${inputWidthFloat}) {\n setOutput(float(${extrapolationValue}));\n return;\n }\n\n vec2
sourceFracIndexCR = vec2(in_x,in_y);\n if(${methodId} == 1) {\n // Compute the four integer indices.\n
 ivec2 sourceFloorCR = ivec2(sourceFracIndexCR);\n ivec2 sourceCeilCR =
 ivec2(ceil(sourceFracIndexCR));\n\n float topLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);\n
 float bottomLeft = getImage(b, sourceCeilCR.y, sourceFloorCR.x, d);\n float topRight = getImage(b,
sourceFloorCR.y, sourceCeilCR.x, d);\n float bottomRight = getImage(b, sourceCeilCR.y, sourceCeilCR.x,
d);\n\n vec2 fracCR = sourceFracIndexCR - vec2(sourceFloorCR);\n\n float top = topLeft + (topRight -
topLeft) * fracCR.x;\n float bottom = bottomLeft + (bottomRight
- bottomLeft) * fracCR.x;\n float newValue = top + (bottom - top) * fracCR.y;\n
setOutput(newValue);\n } else {\n // Compute the coordinators of nearest neighbor point.\n ivec2
sourceNearestCR = ivec2(floor(\n sourceFracIndexCR + vec2(0.5,0.5)));
float newValue =
getImage(b, sourceNearestCR.y, sourceNearestCR.x, d);\n setOutput(newValue);\n }\n }\n `;\n
}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{CropAndResizeProgram} from '../crop_and_resize_gpu';\n\nexport const cropAndResize = (args: {\n inputs:
CropAndResizeInputs,\n backend: MathBackendWebGL,\n attrs: CropAndResizeAttrs\n}): TensorInfo => {\n
const {inputs, backend, attrs} = args;\n const {image, boxes, boxInd} = inputs;\n const {cropSize, method,
extrapolationValue} = attrs;\n\n const program = new CropAndResizeProgram(\n image.shape as [number,
number, number, number],\n boxes.shape as [number, number], cropSize, method, extrapolationValue);\n return
backend.runWebGLProgram(program, [image, boxes, boxInd], 'float32');\n};\n\nexport const
cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'webgl',\n kernelFunc:
cropAndResize as {\n } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,

```

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```
=====\n*\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from\n './shader_compiler';\n\nexport class CumSumProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for speed.\n index:\n WebGLUniformLocation;\n\n constructor(shape: number[], exclusive: boolean, reverse: boolean) {\n this.outputShape = shape;\n const rank = shape.length;\n const val = exclusive ? '0.0' : `getX(${getCoords(rank,\n 'coords')})`; \n const length = shape[shape.length - 1];\n let condition = ";\n let idxString = ";\n // When\n exclusive is set, the cumsum op becomes roll op that copies the\n // value from the previous index based on the\n direction specified by the\n // reverse flag.\n if (exclusive) {\n condition = reverse ? `end != ${length - 1}` :\n `end != 0`;\n idxString = reverse ? `end + 1` : `end - 1`;\n } else {\n condition = reverse ? `end + pow2 <\n ${length}` : `end >= pow2`;\n idxString = (reverse ? `end + pow2` : `end - pow2`);\n }\n\n this.userCode = `\n uniform float index;\n void main() {\n ${getCoordsDataType(rank)} coords =\n getOutputCoords();\n int end = ${getFinalCoord(rank, 'coords')};\n float val = ${val};\n int pow2 =\n int(pow(2.0, index));\n if (${condition}) {\n int idx = ${idxString};\n ${getFinalCoord(rank,\n 'coords')} = idx;\n val += getX(${getCoords(rank, 'coords')});\n }\n setOutput(val);\n }\n`;\n\n getCustomSetupFunc(index: number) {\n return (gpgpu: GPGPUContext, webGLProgram:\n WebGLProgram) => {\n if (this.index == null) {\n this.index = gpgpu.getUniformLocation(webGLProgram,\n 'index');\n }\n gpgpu.gl.uniform1f(this.index, index);\n }; \n }\n\n function getCoords(rank: number,\n name: string): string {\n if (rank === 1) {\n return `${name}`;\n } else if (rank === 2) {\n return `${name}.x,\n ${name}.y`;\n } else if (rank === 3) {\n return `${name}.x, ${name}.y,\n ${name}.z`;\n } else if (rank === 4) {\n return `${name}.x, ${name}.y, ${name}.z, ${name}.w`;\n } else {\n throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n }\n }\n\n function getFinalCoord(rank:\n number, name: string): string {\n if (rank === 1) {\n return `${name}`;\n } else if (rank === 2) {\n return\n `${name}.y`;\n } else if (rank === 3) {\n return `${name}.z`;\n } else if (rank === 4) {\n return\n `${name}.w`;\n } else {\n throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n }\n }\n }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS\n IS\"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n */\n}
```

```
=====\n*\n\nimport {backend_util, Cumsum, CumsumAttrs, CumsumInputs, KernelConfig, KernelFunc, TensorInfo} from\n '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {CumSumProgram}\n from './cumsum_gpu';\nimport {identity} from './Identity';\nimport {transpose} from './Transpose';\n\nexport\n function cumsum(\n args:\n {\n inputs: CumsumInputs, backend: MathBackendWebGL, attrs: CumsumAttrs\n }):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, exclusive, reverse} =\n attrs;\n\n const xRank = x.shape.length;\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutation}});\n }\n const permutedAxis =\n backend_util.getInnerMostAxes(1, xRank)[0];\n\n if (permutedAxis !== xRank - 1) {\n throw new Error(\n `WebGL cumsum shader expects an inner-most axis=${\n x.shape.length - 1}` +\n `but got\n axis=${axis}`);\n }\n const size = permutedX.shape[permutedAxis];\n let result = identity({inputs: {x:\n permutedX}, backend});\n // Use cumsum parallel algorithm, ref:\n //
```

```

https://developer.nvidia.com/gpugems/gpugems3/part-vi-gpu-computing/chapter-39-parallel-prefix-sum-scan-cuda
for (let i = 0; i <= Math.ceil(Math.log2(size)) - 1; i++) {
 const program = new CumSumProgram(permutedX.shape, false, reverse);
 const customSetup = program.getCustomSetupFunc(i);
 const prevResult = result;
 result = backend.runWebGLProgram(program, [result], result.dtype, customSetup);
 backend.disposeIntermediateTensorInfo(prevResult);
} // For exclusive cumsum, shift the end result in the direction of sum // and add 0 to the front index.
if (exclusive) {
 const program = new CumSumProgram(permutedX.shape, exclusive, reverse);
 const prevResult = result;
 result = backend.runWebGLProgram(program, [result], result.dtype);
 backend.disposeIntermediateTensorInfo(prevResult);
}
if (permutation != null) {
 const reversePermutation = backend_util.getUndoAxesPermutation(permutation);
 const reverseTransposedResult = transpose({ inputs: { x: result }, backend, attrs: { perm: reversePermutation } });
 backend.disposeIntermediateTensorInfo(result);
 backend.disposeIntermediateTensorInfo(permutedX);
}
return reverseTransposedResult;
}
return result;
}
export const cumsumConfig: KernelConfig = {
 kernelName: Cumsum,
 backendName: 'webgl',
 kernelFunc: cumsum as { } as KernelFunc;
};
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 */
=====
import { DenseBincount, DenseBincountAttrs, DenseBincountInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray } from '@tensorflow/tfjs-core';
import { MathBackendWebGL } from '../backend_webgl';
import { bincountImplCPU, bincountReduceImplCPU } from './kernel_utils/shared';
export function denseBincount({
 inputs: DenseBincountInputs,
 backend: MathBackendWebGL,
 attrs: DenseBincountAttrs
}): TensorInfo {
 const { inputs, backend, attrs } = args;
 const { x, weights } = inputs;
 const { size, binaryOutput } = attrs;
 if (x.shape.length === 1) {
 const xVals = backend.readSync(x.dataId) as TypedArray;
 const weightsVals = backend.readSync(weights.dataId) as TypedArray;
 const outVals = bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape, size);
 return backend.makeTensorInfo([size], weights.dtype, outVals);
 } else if (x.shape.length === 2) {
 const xBuf = backend.bufferSync(x);
 const weightsBuf = backend.bufferSync(weights);
 const outBuf = bincountReduceImplCPU(xBuf, weightsBuf, size, binaryOutput);
 return backend.makeTensorInfo(outBuf.shape, weights.dtype, outBuf.values);
 }
 throw new Error(`Error in denseBincount: input must be at most rank 2, but got rank` + x.shape.length);
}
export const denseBincountConfig: KernelConfig = {
 kernelName: DenseBincount,
 backendName: 'webgl',
 kernelFunc: denseBincount as { } as KernelFunc;
};
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 * limitations under the License.
 */
=====
import { GPGPUProgram } from './gpgpu_math';
export class DepthToSpaceProgram implements GPGPUProgram {
 variableNames = ['x'];
 outputShape:

```

```

number[] = [];\n userCode: string;\n blockSize: number;\n dataFormat: string;\n\n constructor(\n outputShape:
number[], blockSize: number, dataFormat: 'NHWC'|'NCHW') {\n this.outputShape = outputShape;\n
this.blockSize = blockSize;\n this.dataFormat = dataFormat;\n this.userCode = `\n void main() {\n ivec4
coords = getOutputCoords();\n int b = coords[0];\n int h = ${this.getHeightCoordString()};\n int w =
${this.getWidthCoordString()};\n int d = ${this.getDepthCoordString()};\n int in_h = h / ${blockSize};\n
int offset_h = imod(h, ${blockSize});\n int in_w = w / ${blockSize};\n int offset_w = imod(w,
${blockSize});\n int offset_d = (offset_h * ${blockSize} + offset_w) *\n ${this.getOutputDepthSize()};\n
int in_d = d + offset_d;\n\n float result = ${this.getInputSamplingString()};\n setOutput(result);\n }\n `;\n
}\n\n private getHeightCoordString(): string {\n if (this.dataFormat
=== 'NHWC') {\n return `coords[1]`;}\n } else {\n return `coords[2]`;}\n }\n}\n\n private
getWidthCoordString(): string {\n if (this.dataFormat === 'NHWC') {\n return `coords[2]`;}\n } else {\n
return `coords[3]`;}\n }\n}\n\n private getDepthCoordString(): string {\n if (this.dataFormat === 'NHWC') {\n
return `coords[3]`;}\n } else {\n return `coords[1]`;}\n }\n}\n\n private getOutputDepthSize(): number {\n if
(this.dataFormat === 'NHWC') {\n return this.outputShape[3];}\n } else {\n return this.outputShape[1];}\n
}\n}\n\n private getInputSamplingString(): string {\n if (this.dataFormat === 'NHWC') {\n return `getX(b,
in_h, in_w, in_d)`;\n } else {\n return `getX(b, in_d, in_h, in_w)`;\n }\n}\n}\n\n"/**\n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
\n
=====\n
*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{DepthToSpaceProgram} from '../depth_to_space_gpu';\n\nexport function depthToSpace(args: {\n inputs:
DepthToSpaceInputs,\n backend: MathBackendWebGL,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n
 const {blockSize, dataFormat} = attrs;\n util.assert(\n blockSize > 1,\n () => `blockSize should be > 1 for
depthToSpace, but was: ${blockSize}`);\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n const outputHeight = inputHeight *
blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize *
blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth,
outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n const program = new
DepthToSpaceProgram(outputShape, blockSize, dataFormat);\n return backend.runWebGLProgram(program, [x],
x.dtype);\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n
backendName: 'webgl',\n kernelFunc:
 depthToSpace as {} as KernelFunc\n};\n"/**\n * Copyright 2017 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n
=====\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from

```

```

'/gpgpu_math';\n\nexport class DepthwiseConv2DProgram implements GPGPUProgram {\n variableNames = ['x',
'W'];\n outputShape: number[];\n userCode:
string;\n\n constructor(\n convInfo: backend_util.Conv2DInfo, addBias = false,\n activation: string = null,
hasPreluActivation = false,\n hasLeakyReluAlpha = false) {\n this.outputShape = convInfo.outShape;\n\n const xNumRows = convInfo.inHeight;\n const xNumCols = convInfo.inWidth;\n const padTop =
convInfo.padInfo.top;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
dilationWidth = convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n let
activationSnippet = "", applyActivationSnippet = "";\n if (activation) {\n if (hasPreluActivation) {\n
activationSnippet = `float activation(float a) {\n float b = getPreluActivationWeightsAtOutCoords();\n
 ${activation}\n }`;\n } else if (hasLeakyReluAlpha) {\n activationSnippet = `float activation(float
a) {\n float b = getLeakyreluAlphaAtOutCoords();\n ${activation}\n }`;\n } else {\n
activationSnippet = `\n float activation(float x) {\n ${activation}\n }\n `;\n }\n\n applyActivationSnippet = `result = activation(result)`;\n }\n\n const addBiasSnippet = addBias ? `result +=
getBiasAtOutCoords();` : "";\n if (addBias) {\n this.variableNames.push('bias');\n }\n\n if
(hasPreluActivation) {\n this.variableNames.push('preluActivationWeights');\n }\n if (hasLeakyReluAlpha)
{\n this.variableNames.push('leakyreluAlpha');\n }\n\n this.userCode = `\n ${activationSnippet}\n\n
const ivec2 strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop},
${padLeft});\n\n void main() {\n ivec4
coords = getOutputCoords();\n int batch = coords.x;\n ivec2 xRCCorner = coords.yz * strides - pads;\n
int d2 = coords.w;\n int d1 = d2 / ${channelMul};\n int q = d2 - d1 * ${channelMul};\n\n int xRCorner
= xRCCorner.x;\n int xCCorner = xRCCorner.y;\n\n // Convolve x(?, ?, d1) with w(:, :, d1, q) to get y(yR,
yC, d2).\n // ? = to be determined. := across all values in that axis.\n float dotProd = 0.0;\n // TO
DO(dsmilkov): Flatten the two for loops and vec4 the operations.\n for (int wR = 0; wR < ${filterHeight};
wR++) {\n int xR = xRCorner + wR * ${dilationHeight};\n if (xR < 0 || xR >= ${xNumRows}) {\n
continue;\n }\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC *
${dilationWidth};\n if (xC < 0 || xC >= ${xNumCols}) {\n continue;\n }\n\n float
xVal = getX(batch, xR,
xC, d1);\n float wVal = getW(wR, wC, d1, q);\n dotProd += xVal * wVal;\n }\n }\n
float result = dotProd;\n ${addBiasSnippet}\n ${applyActivationSnippet}\n setOutput(result);\n }\n
`;\n }\n}\n\n", /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n *
=====\n
*/\n\nimport
{backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class DepthwiseConvPacked2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n packedInputs =
true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n constructor(\n convInfo:
backend_util.Conv2DInfo, addBias = false,\n activation: string = null, hasPreluActivation = false,\n
hasLeakyReluAlpha = false) {\n this.outputShape = convInfo.outShape;\n\n const xNumRows =
convInfo.inHeight;\n const xNumCols = convInfo.inWidth;\n const padTop = convInfo.padInfo.top;\n const
padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =

```

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convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const texelsAcross
= filterWidth;\n\n let mainLoop = `int xR; int xC; int xCOffset;`;
for (let r = 0; r < filterHeight; r++) {\n
for (let c = 0; c < filterWidth; c++) {\n mainLoop += `\n vec4 xTexelR${r}C${c * 2} = vec4(0.);
vec4 wR${r}C${c} = vec4(0.); \n vec4 xR${r}C${c} = vec4(0.);`; \n } \n } \n\n /*\n * This vectorized
implementation works by gathering the values needed for\n * each output channel's dot product into vec4's and
then multiplying them\n * all together (this happens in the final double for-loop below). Most of\n * the main
loop consists of constructing these vec4's with the minimum\n * number of texture2D calls, which means making
use of all four returned\n * values from a texture2D call at once.\n */\n for (let r = 0; r < filterHeight; r++) {\n
for (let texelC = 0; texelC < texelsAcross; texelC++) {\n const c = texelC * 2;\n mainLoop += `\n
xR = xRCorner + ${r *
dilationHeight};\n xC = xCCorner + ${c * dilationWidth};\n `;\n\n if (strideWidth === 1) {\n if
(c < filterWidth) {\n // If padding is odd, the outer texels have to be composed.\n if (padLeft % 2 ===
1) {\n // TODO: Ensure vec4 previous does not result in redundant sample,\n // and avoid setting
xTexelRC's that exceed the boundary in the\n // first place rather than resetting them to vec4(0)).\n\n
// To compute xCOffset:\n // - If padding is odd, we must add 1 to ensure we ask for an\n // even-
numbered row.\n // - We subtract 2 to access the previous texel.\n\n mainLoop += `\n
xCOffset = xC + 1;\n if(xR >= 0 && xR < ${xNumRows} && xCOffset >= 0 && xCOffset < ${\n
xNumCols}) {\n xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);\n } \n // Need to
manually
clear unused channels in case\n // we're reading from recycled texture.\n if(xCOffset + 1 >=
${xNumCols}) {\n xTexelR${r}C${c}.zw = vec2(0.); \n } \n } else {\n
xTexelR${r}C${c} = vec4(0.); \n }\n\n xCOffset = xC + 1 - 2;\n if(xR >= 0 && xR <
${xNumRows} && xCOffset >= 0 && xCOffset < ${\n xNumCols}) {\n vec4 previous =
getX(batch, xR, xCOffset, d1);\n } \n // Need to manually clear unused channels in case\n // we're
reading from recycled texture.\n if(xCOffset + 1 >= ${xNumCols}) {\n previous.zw =
vec2(0.); \n } \n }\n xR${r}C${c} = vec4(previous.zw, xTexelR${r}C${c}.xy); \n } else
{\n xR${r}C${c} = vec4(0, 0, xTexelR${r}C${c}.xy); \n } \n `;\n } else
{\n // Padding is even, so xRC corresponds to a single texel.\n mainLoop += `\n if(xR >=
0 && xR < ${xNumRows} && xC >= 0 && xC < ${xNumCols}) {\n xTexelR${r}C${c} = getX(batch,
xR, xC, d1); \n } \n } else {\n xTexelR${r}C${c} = vec4(0.); \n }\n\n
xR${r}C${c} = xTexelR${r}C${c}; \n `;\n }\n }\n if (c + 1 < filterWidth) {\n // If
dilation is even, the second entry should match the first\n // (either both are composed or both are single
samples). But if\n // dilation is odd, then the second entry should be the opposite\n // of the first (if
the first is composed, the second is a single\n // sample, and vice versa.)\n\n const nextTexelOffset =
padLeft % 2 === 0 ?\n util.nearestLargerEven(dilationWidth) : \n dilationWidth;\n\n if
(((dilationWidth % 2 === 0 && padLeft % 2 === 1) || \n (dilationWidth % 2 !== 0 && padLeft % 2
!== 1)) {\n mainLoop += `\n xCOffset = xC + ${padLeft % 2} + ${nextTexelOffset};\n\n
if(xR >= 0 && xR < ${xNumRows} && \n xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
xTexelR${r}C${c + 2} = getX(batch, xR, xCOffset, d1); \n } \n `;\n } \n // If dilation
> 1 then the xRC's will not be able to share any\n // values, so each xRC will require two unique calls to
getX.\n if (dilationWidth > 1) {\n mainLoop += `\n xCOffset -= 2;\n\n
if(xR >= 0 && xR < ${xNumRows} && \n xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1); \n } \n } \n } else {\n xTexelR${r}C${c}
= vec4(0.); \n } \n `;\n }\n }\n mainLoop += `\n xR${r}C${c + 1}
= vec4(\n xTexelR${r}C${c}.zw, xTexelR${r}C${c + 2}.xy); \n `;\n } \n } else {\n
mainLoop += `\n xCOffset = xC + ${nextTexelOffset};\n if(xR >= 0 && xR <
${xNumRows} && \n xCOffset >= 0 && xCOffset < ${xNumCols}) {\n xTexelR${r}C${c}

```

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+ 2} = getX(batch, xR, xCOffset, d1);
 } else { // stride > 1
 if (c < filterWidth) {
 // Depending on whether padLeft is even or odd, we want either the xy or zw channels from X texels for xR{r}C{c}.
 // If padLeft is even, xR{r}C{c+1} is simply the zw channels of texels we've already sampled. But if padLeft is odd, xR{r}C{c+1}.zw will need to come from the xy channels of a new texel, hence the final initialized below.
 if (padLeft % 2 === 1) {
 xCOffset = xC + 1 - {strideWidth};
 if (xCOffset >= 0 && xCOffset < {xNumCols}) {
 xTexelR{r}C{c} = getX(batch, xR, xCOffset, d1);
 } else {
 xTexelR{r}C{c} = vec4(0.);
 }
 if (xC + 1 >= 0 && xC + 1 < {xNumCols}) {
 xTexelR{r}C{c+2} = getX(batch, xR, xC + 1, d1);
 } else {
 xTexelR{r}C{c+2} = vec4(0.);
 }
 xR{r}C{c} = vec4(xTexelR{r}C{c}.zw, xTexelR{r}C{c+2}.zw);
 } else {
 mainLoop += 1;
 vec4 final = vec4(0.);
 xCOffset = xC + 1 + {strideWidth};
 if (xCOffset >= 0 && xCOffset < {xNumCols}) {
 final = getX(batch, xR, xCOffset, d1);
 }
 xR{r}C{c+1} = vec4(xTexelR{r}C{c+2}.xy, final.xy);
 } else {
 mainLoop += 1;
 if (xC >= 0 && xC < {xNumCols}) {
 xTexelR{r}C{c} = getX(batch, xR, xC, d1);
 } else {
 xTexelR{r}C{c} = vec4(0.);
 }
 xCOffset = xC + {strideWidth};
 if (xCOffset >= 0 && xCOffset < {xNumCols}) {
 xTexelR{r}C{c+2} = getX(batch, xR, xCOffset, d1);
 } else {
 xTexelR{r}C{c+2} = vec4(0.);
 }
 xR{r}C{c} = vec4(xTexelR{r}C{c}.xy, xTexelR{r}C{c+2}.xy);
 }
 if (c + 1 < filterWidth) {
 mainLoop += 1;
 xR{r}C{c+1} = vec4(xTexelR{r}C{c}.zw, xTexelR{r}C{c+2}.zw);
 }
 }
 if (c < filterWidth) {
 mainLoop += 1;
 vec4 wTexelR{r}C{c} = getW({r}, {c}, d1, q);
 wR{r}C{c} = vec4(wTexelR{r}C{c}.xz, wTexelR{r}C{c}.xz);
 }
 if (c + 1 < filterWidth) {
 mainLoop += 1;
 vec4 wTexelR{r}C{c+1} = getW({r}, {c+1}, d1, q);
 wR{r}C{c+1} = vec4(wTexelR{r}C{c+1}.xz, wTexelR{r}C{c+1}.xz);
 }
 for (let r = 0; r < filterHeight; r++) {
 for (let c = 0; c < filterWidth; c++) {
 mainLoop += 1;
 dotProd += xR{r}C{c} * wR{r}C{c};
 }
 let activationSnippet = "", applyActivationSnippet = "";
 if (activation) {
 if (hasPreluActivation) {
 activationSnippet = `vec4 activation(vec4 a) {
 vec4 b = getPreluActivationWeightsAtOutCoords();
 ${activation}
 }`;
 } else if (hasLeakyReluAlpha) {
 activationSnippet = `vec4 activation(vec4 a) {
 vec4 b = getLeakyreluAlphaAtOutCoords();
 ${activation}
 }`;
 } else {
 activationSnippet = `vec4 activation(vec4 x) {
 ${activation}
 }`;
 }
 applyActivationSnippet = `result = activation(result);`;
 const addBiasSnippet = `addBias ? result += getBiasAtOutCoords();`;
 if (addBias) {
 this.variableNames.push('bias');
 }
 if (hasPreluActivation) {
 this.variableNames.push('preluActivationWeights');
 }
 if (hasLeakyReluAlpha) {
 this.variableNames.push('leakyreluAlpha');
 }
 this.userCode = `
 ${activationSnippet}
 const ivec2 strides = ivec2({strideHeight}, {strideWidth});
 const ivec2 pads = ivec2({padTop}, {padLeft});
 void main() {
 ivec4 coords = getOutputCoords();
 int batch = coords.x;
 ivec2 xRCCorner = coords.yz * strides - pads;
 int d2 = coords.w;
 int d1 = d2;
 int q = 0;
 int xRCorner = xRCCorner.x;
 int xCCorner = xRCCorner.y;
 vec4 dotProd = vec4(0.);
 ${mainLoop}
 vec4 result = dotProd;
 ${addBiasSnippet}
 ${applyActivationSnippet}
 setOutput(result);
 }`;
 }
 }
}

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```
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, env, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {DepthwiseConv2DProgram} from
'./conv_gpu_depthwise';\n\nimport {DepthwiseConvPacked2DProgram} from
'./conv_packed_gpu_depthwise';\n\nexport function depthwiseConv2dNative(args: {\n inputs:
DepthwiseConv2dNativeInputs,\n attrs: DepthwiseConv2dNativeAttrs,\n backend: MathBackendWebGL\n}) {\n
const {inputs, backend,
attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad, dilations, dimRoundingMode} = attrs;\n\n let
$dilations = dilations;\n if ($dilations == null) {\n $dilations = [1, 1];\n }\n\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, $dilations),\n () => 'Error in depthwiseConv2d: Either
strides or dilations must be ' +\n `1. Got strides ${strides} and dilations '${dilations}'`);\n\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as
[number, number, number, number], strides, $dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n let
program: DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n if
(env().getBool('WEBGL_PACK_DEPTHWISECONV') && convInfo.strideWidth <= 2 &&\n
convInfo.outChannels / convInfo.inChannels === 1) {\n program = new
DepthwiseConvPacked2DProgram(convInfo);\n } else {\n program = new
DepthwiseConv2DProgram(convInfo);\n
}\n\n return backend.runWebGLProgram(program, [x, filter], 'float32');\n}\n\nexport const
depthwiseConv2dNativeConfig: KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName:
'webgl',\n kernelFunc: depthwiseConv2dNative as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2018
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
```

```
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class DepthwiseConv2DDerFilterProgram implements GPGPUProgram {\n
variableNames = ['x', 'dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv2DInfo) {\n this.outputShape = convInfo.filterShape;\n\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const padTop = convInfo.padInfo.top;\n
const padLeft = convInfo.padInfo.left;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n
this.userCode = `\n void main() {\n ivec4 coords = getOutputCoords();\n int wR = coords.x;\n int
wC = coords.y;\n int d1 = coords.z;\n int dm = coords.w;\n int d2 = d1 * ${channelMul} + dm;\n\n
float dotProd = 0.0;\n // TO DO: Vec4 over the batch size\n for (int b = 0; b < ${convInfo.batchSize};
b++) {\n
for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\n int xR = wR + yR * ${strideHeight} -
${padTop};\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n for (int
yC = 0; yC < ${convInfo.outWidth}; yC++) {\n int xC = wC + yC * ${strideWidth} - ${padLeft};\n\n
if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n\n float dyValue = getDy(b,
```

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yR, yC, d2);\n float xValue = getX(b, xR, xC, d1);\n dotProd += (xValue * dyValue);\n }\n }\n setOutput(dotProd);\n }\n `;\n}\n}\n\nexport class DepthwiseConv2DDerInputProgram
implements GPGPUProgram {\n variableNames = ['dy', 'W'];\n outputShape: number[];\n userCode: string;\n constructor(convInfo: backend_util.Conv2DInfo) {\n this.outputShape = convInfo.inShape;\n const
filterHeight = convInfo.filterHeight;\n
 const filterWidth = convInfo.filterWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const padTop = filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth
- 1 - convInfo.padInfo.left;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n
this.userCode = `\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void main() {\n ivec4 coords =
getOutputCoords();\n int batch = coords[0];\n int d1 = coords[3];\n ivec2 dyCorner = coords.yz -
pads;\n int dyRCorner = dyCorner.x;\n int dyCCorner = dyCorner.y;\n\n float dotProd = 0.0;\n\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n float dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n
 if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n continue;\n }\n int
idyR = int(dyR);\n int wRPerm = ${filterHeight}
- 1 - wR;\n\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) /
${strideWidth}.0;\n if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n
 continue;\n }\n int idyC = int(dyC);\n int wCPerm = ${filterWidth} - 1 - wC;\n\n //
TO DO: Vec4 over the channelMul\n for (int dm = 0; dm < ${channelMul}; dm++) {\n int d2 = d1 *
${channelMul} + dm;\n float xValue = getDy(batch, idyR, idyC, d2);\n float wValue =
getW(wRPerm, wCPerm, d1, dm);\n dotProd += xValue * wValue;\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n}\n}\n\n",`*\n * @license\n * Copyright 2020 Google LLC. All Rights
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*\n
=====\n
*\n\nimport {backend_util, DepthwiseConv2dNativeBackpropFilter, DepthwiseConv2dNativeBackpropFilterAttrs,
DepthwiseConv2dNativeBackpropFilterInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {DepthwiseConv2DDerFilterProgram} from
'./conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropFilter(args: {\n inputs:
DepthwiseConv2dNativeBackpropFilterInputs,\n attrs: DepthwiseConv2dNativeBackpropFilterAttrs,\n backend:
MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, dy} = inputs;\n const
{strides, dilations, pad, dimRoundingMode, filterShape} = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number], filterShape, strides,\n dilations, pad, dimRoundingMode, true /* depthwise */);\n\n const program = new
DepthwiseConv2DDerFilterProgram(convInfo);\n return backend.runWebGLProgram(program, [x, dy],
'float32');\n}\n\nexport const depthwiseConv2dNativeBackpropFilterConfig: KernelConfig = {\n kernelName:
DepthwiseConv2dNativeBackpropFilter,\n backendName: 'webgl',\n kernelFunc:
depthwiseConv2dNativeBackpropFilter as {} as KernelFunc\n};\n\n",`*\n * @license\n * Copyright 2020 Google
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*\n
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*\n\nimport { backend_util, DepthwiseConv2dNativeBackpropInput, DepthwiseConv2dNativeBackpropInputAttrs,
DepthwiseConv2dNativeBackpropInputInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {DepthwiseConv2DDerInputProgram} from
'./conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropInput(args: {\n inputs:
DepthwiseConv2dNativeBackpropInputInputs,\n attrs: DepthwiseConv2dNativeBackpropInputAttrs,\n backend:
MathBackendWebGL\n})
{\n const {inputs, backend, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, dilations, pad,
dimRoundingMode, inputShape} = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n inputShape,
filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode, true /*
depthwise */);\n\n const program = new DepthwiseConv2DDerInputProgram(convInfo);\n return
backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const
depthwiseConv2dNativeBackpropInputConfig: KernelConfig = {\n kernelName:
DepthwiseConv2dNativeBackpropInput,\n backendName: 'webgl',\n kernelFunc:
depthwiseConv2dNativeBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class DiagProgram implements GPGPUProgram
{\n variableNames = ['X'];\n outputShape: number[];\n userCode: string;\n\n constructor(size: number) {\n
this.outputShape = [size, size];\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n
float val = coords[0] == coords[1] ? getX(coords[0]) : 0.0;\n setOutput(val);\n }\n `;\n }\n\n"/**\n
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License for the specific language governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {Diag, DiagInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {DiagProgram} from
'./diag_gpu';\n\nimport {reshape} from './Reshape';\n\nexport function diag(args: {inputs: DiagInputs, backend:
MathBackendWebGL});\n\n TensorInfo {\n const {inputs, backend} = args;\n const
{x} = inputs;\n\n const outShape = [...x.shape, ...x.shape];\n const xSize = util.sizeFromShape(x.shape);\n\n const
flat = reshape({inputs: {x}, backend, attrs: {shape: [xSize]}});\n\n const program = new DiagProgram(xSize);\n
const res = backend.runWebGLProgram(program, [flat], flat.dtype);\n\n const out = reshape({inputs: {x: res},
backend, attrs: {shape: outShape}});\n\n backend.disposeIntermediateTensorInfo(flat);\n
backend.disposeIntermediateTensorInfo(res);\n\n return out;\n}\n\nexport const diagConfig: KernelConfig = {\n
kernelName: Diag,\n backendName: 'webgl',\n kernelFunc: diag as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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=====\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class Dilation2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n this.outputShape = convInfo.outShape;\n\n const {\n inHeight,\n inWidth,\n padInfo,\n strideHeight,\n strideWidth,\n filterHeight,\n filterWidth,\n dilationHeight,\n dilationWidth\n } = convInfo;\n\n const {top: padTop, left: padLeft} = padInfo;\n\n this.userCode =`\n const ivec2\n strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n const float neg_infinity = -3.4e38;\n\n void main() {\n ivec4 coords = getOutputCoords();\n int batch = coords.x;\n int d1 = coords.w;\n ivec2 outTopLeftCorner =\n coords.yz * strides - pads;\n int hBeg = outTopLeftCorner.x;\n int wBeg = outTopLeftCorner.y;\n float curVal = neg_infinity;\n for (int h = 0; h < ${filterHeight}; h++) {\n int hIn = hBeg + h * ${dilationHeight};\n if (hIn >= 0 && hIn < ${inHeight}) {\n for (int w = 0; w < ${filterWidth}; w++) {\n int wIn = wBeg + w * ${dilationWidth};\n if (wIn >= 0 && wIn < ${inWidth}) {\n float xVal = getX(batch, hIn, wIn, d1);\n float wVal = getW(h, w, d1);\n float val = xVal + wVal;\n if (val > curVal) {\n curVal =\n val;\n }\n }\n }\n }\n }\n float result = curVal;\n setOutput(result);\n }\n `;\n }\n}\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\n\nimport {backend_util, Dilation2D, Dilation2DAttrs, Dilation2DInputs, KernelConfig, KernelFunc, TensorInfo}\n\nfrom '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {Dilation2DProgram} from './dilation_gpu';\nimport {reshape} from './Reshape';\n\nexport function dilation2D(args: {\n inputs: Dilation2DInputs,\n attrs: Dilation2DAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad, dilations} = attrs;\n\n const convInfo = backend_util.computeDilation2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as [number, number, number],\n strides, pad,\n 'NHWC' /* dataFormat */,\n dilations);\n\n let out: TensorInfo;\n\n const program = new Dilation2DProgram(convInfo);\n out = backend.runWebGLProgram(program, [x, filter], 'float32');\n\n const outReshaped =\n reshape({inputs: {x: out}, backend, attrs: {shape: convInfo.outShape}});\n\n backend.disposeIntermediateTensorInfo(out);\n\n return outReshaped;\n}\n\nexport const dilation2DConfig: KernelConfig\n = {\n kernelName: Dilation2D,\n backendName: 'webgl',\n kernelFunc: dilation2D as {\n KernelFunc\n }\n };\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```

=====
*/\n\nimport {Elu, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
 './kernel_utils/kernel_funcs_utils';\n\nconst ELU = `return
(x >= 0.0) ? x : (exp(x) - 1.0);`;
\n\nconst ELU_PACKED = `\n vec4 result;\n\n result.r = (x.r >= 0.0) ? x.r :
(exp(x.r) - 1.0);\n result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);\n result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);\n
result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);\n\n return result;\n`;
\n\nconst elu = unaryKernelFunc({opSnippet:
ELU, packedOpSnippet: ELU_PACKED});
\n\nexport const eluConfig: KernelConfig = {\n kernelName: Elu,\n backendName: 'webgl',\n kernelFunc: elu as {} as KernelFunc\n};
\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {EluGrad, EluGradInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {BinaryOpProgram} from
 '../binaryop_gpu';\nimport {BinaryOpPackedProgram} from '../binaryop_packed_gpu';\n\nconst ELU_DER = `return
(b >= 1.0) ? a : a * (b + 1.0);`;
\n\nconst ELU_DER_PACKED = `\n vec4 bGTEZero = vec4(greaterThanEqual(b,
vec4(0.0)));
\n return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));
\n`;
\n\nexport const eluGrad
= \n (args: {inputs: EluGradInputs, backend: MathBackendWebGL}): TensorInfo => {\n const {inputs,
backend} = args;\n const {dy, y} = inputs;\n const program =
env().getBool('WEBGL_PACK_BINARY_OPERATIONS')
? \n new BinaryOpPackedProgram(ELU_DER_PACKED, dy.shape, y.shape) : \n new
BinaryOpProgram(ELU_DER, dy.shape, y.shape);
\n return backend.runWebGLProgram(program, [dy, y],
dy.dtype);
\n };
\n\nexport const eluGradConfig: KernelConfig = {\n kernelName: EluGrad,\n backendName:
'webgl',\n kernelFunc: eluGrad as {} as KernelFunc\n};
\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {Equal, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc} from
 './kernel_utils/kernel_funcs_utils';\n\nconst PACKED_EQUAL = `\n return vec4(equal(a, b));
\n`;
\n\nconst EQUAL
= `return float(a == b);`;
\n\nexport const equal = binaryKernelFunc(\n {opSnippet: EQUAL, packedOpSnippet:
PACKED_EQUAL, dtype: 'bool'});
\n\nexport const equalConfig: KernelConfig = {\n kernelName: Equal,\n backendName: 'webgl',\n kernelFunc: equal as {} as KernelFunc\n};
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*/\n\nimport {backend_util, Erf, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from

```

```

./kernel_utils/kernel_funcs_utils';\n\nconst ERF = \n // Error function is calculated approximately with elementary
function.\n // See \"Handbook of Mathematical Functions with Formulas,\n // Graphs, and Mathematical Tables\",
Abramowitz and Stegun.\n float p = ${backend_util.ERF_P};\n float a1 = ${backend_util.ERF_A1};\n float a2 =
${backend_util.ERF_A2};\n float a3 = ${backend_util.ERF_A3};\n float a4 = ${backend_util.ERF_A4};\n float
a5 = ${backend_util.ERF_A5};\n\n float sign = sign(x);\n x = abs(x);\n float t = 1.0 / (1.0 + p * x);\n return sign *
(1.0 - (((a5*t
+ a4)*t) + a3)*t + a2)*t + a1)*t*exp(-x*x));\n`;\n\nexport const erf = unaryKernelFunc({opSnippet:
ERF});\n\nexport const erfConfig: KernelConfig = {\n kernelName: Erf,\n backendName: 'webgl',\n kernelFunc:
erf,\n};\n\n\", \"/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs:
ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: MathBackendWebGL\n}): TensorInfo {\n const
{inputs, attrs, backend} = args;\n const {dim} = attrs;\n const {input} = inputs;\n\n const inputRank =
input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value
is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the
interval [${- (inputRank + 1)}, ${\n inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs: {x: input}, backend, attrs: {shape:
newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n
backendName: 'webgl',\n kernelFunc: expandDims
as {} as KernelFunc,\n};\n\n\", \"/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FFTProgram implements GPGPUProgram {\n
variableNames = ['real', 'imag'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n component:
'real'|'imag', inputShape:
[number, number],\n inverse: boolean) {\n const innerDim = inputShape[1];\n this.outputShape =
inputShape;\n\n const exponentMultiplierSnippet =\n inverse ? `2.0 * ${Math.PI}` : `-.2.0 * ${Math.PI}`;\n
const resultDenominator = inverse ? `${innerDim}.0` : '1.0';\n\n let opString: string;\n if (component === 'real')
{\n opString = 'return real * expR - imag * expI;'\n } else if (component === 'imag') {\n opString = 'return
real * expI + imag * expR;'\n } else {\n throw new Error(\n `FFT component must be either \"real\" or
\"imag\", got ${component}.`);\n }\n\n this.userCode = `\n const float exponentMultiplier =
${exponentMultiplierSnippet};\n float unaryOpComplex(float real, float expR, float imag, float expI) {\n
${opString}\n }\n\n float mulMatDFT(int batch, int index) {\n float indexRatio = float(index) /
float(${innerDim});\n float exponentMultiplierTimesIndexRatio =\n
exponentMultiplier * indexRatio;\n\n float result = 0.0;\n\n for (int i = 0; i < ${innerDim}; i++) {\n
// x = (-2|2 * PI / N) * index * i;\n float x = exponentMultiplierTimesIndexRatio * float(i);\n float

```

```

expR = cos(x);\n float expI = sin(x);\n float real = getReal(batch, i);\n float imag = getImag(batch, i);\n result +=\n unaryOpComplex(real, expR, imag, expI) / ${resultDenominator};\n }\n return result;\n }\n void main() {\n ivec2 coords = getOutputCoords();\n setOutput(mulMatDFT(coords[0], coords[1]));\n }\n `;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {FFTProgram} from './fft_gpu';\nimport {complex} from './Complex';\nimport {reshape} from './Reshape';\nexport function fftImpl(\n x: TensorInfo, inverse: boolean, backend: MathBackendWebGL): TensorInfo {\n const xData = backend.texData.get(x.dataId);\n const inputSize = util.sizeFromShape(x.shape);\n // Collapse all outer dimensions to a single batch dimension.\n const innerDimensionSize = x.shape[x.shape.length - 1];\n const batch = inputSize / innerDimensionSize;\n const input2D = reshape(\n {inputs: [x], backend, attrs: {shape: [batch, innerDimensionSize]}});\n const xShape = input2D.shape as [number, number];\n const realProgram = new FFTProgram('real', xShape, inverse);\n const imagProgram = new FFTProgram('imag', xShape, inverse);\n const inputs = [\n {\n dataId: xData.complexTensorInfos.real.dataId,\n dtype: xData.complexTensorInfos.real.dtype,\n shape: xShape\n },\n {\n dataId: xData.complexTensorInfos.imag.dataId,\n dtype: xData.complexTensorInfos.imag.dtype,\n shape: xShape\n }\n];\n const realPart = backend.runWebGLProgram(realProgram, inputs, 'float32');\n const imagPart = backend.runWebGLProgram(imagProgram, inputs, 'float32');\n const complexOutput =\n complex({inputs: {real: realPart, imag: imagPart}, backend});\n backend.disposeIntermediateTensorInfo(realPart);\n backend.disposeIntermediateTensorInfo(imagPart);\n const complexOutputReshaped\n =\n reshape({inputs: {x: complexOutput}, backend, attrs: {shape: x.shape}});\n backend.disposeIntermediateTensorInfo(input2D);\n backend.disposeIntermediateTensorInfo(complexOutput);\n return complexOutputReshaped;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
/\n\nimport {FFT, FFTInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {fftImpl} from './FFT_impl';\nexport function fft(args: {inputs: FFTInputs, backend: MathBackendWebGL}): TensorInfo {\n const {inputs, backend} = args;\n const {input} = inputs;\n return fftImpl(input, false / inverse */, backend);\n}\n\nexport const fftConfig: KernelConfig = {\n kernelName: FFT,\n backendName: 'webgl',\n kernelFunc: fft;\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *

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* limitations under the License.
=====
*\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class FillProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n\n valueLoc: WebGLUniformLocation;\n\n constructor(shape: number[], value: number) {\n
this.variableNames = ['x'];\n this.outputShape = shape;\n\n this.userCode = `\n uniform float value;\n void
main() {\n // Input can be obtained from uniform value.\n setOutput(value);\n }\n `;\n\n }\n\n getCustomSetupFunc(value: number) {\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) =>
{\n if (this.valueLoc == null) {\n this.valueLoc = gpgpu.getUniformLocationNoThrow(webGLProgram,
'value');\n }\n gpgpu.gl.uniform1f(this.valueLoc,
value);\n };\n }\n}\n\n",/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {Fill, FillAttrs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\nimport {FillProgram} from './fill_gpu';\n\nexport function
fill(args:
{backend: MathBackendWebGL, attrs: FillAttrs});\n TensorInfo {\n const {backend, attrs} = args;\n const
{shape, value} = attrs;\n let {dtype} = attrs;\n\n dtype = dtype || util.inferDtype(value);\n\n if (dtype === 'string')
{\n // String type should be handled in CPU memory.\n const values = util.getArrayFromDType(dtype,
util.sizeFromShape(shape));\n values.fill(value as string);\n return backend.makeTensorInfo(shape, dtype,
values);\n } else {\n const program = new FillProgram(shape, value as number);\n const customSetup =
program.getCustomSetupFunc(value as number);\n return backend.runWebGLProgram(program, [], dtype,
customSetup);\n }\n }\n\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'webgl',\n
kernelFunc: fill as { } as KernelFunc\n};\n\n",/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FlipLeftRightProgram implements
GPGPUProgram {\n variableNames = ['Image'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(imageShape: [number, number, number, number]) {\n const imageWidth = imageShape[2];\n\n this.outputShape = imageShape;\n\n this.userCode = `\n void main() {\n ivec4 coords =
getOutputCoords();\n int x = coords[2];\n\n int coordX = ${imageWidth} - x;\n float outputValue;\n if(coordX >= 0 && coordX <
${imageWidth}) {\n outputValue = getImage(coords[0], coords[1], coordX, coords[3]);\n } else {\n
outputValue = getImage(coords[0], coords[1], coords[2], coords[3]);\n }\n setOutput(outputValue);\n }
`\n }\n\n }\n\n",/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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```



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```
=====
*\n\nimport {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';\nimport {FlipLeftRight, FlipLeftRightInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {FlipLeftRightProgram} from './flip_left_right_gpu';\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'webgl',\n kernelFunc: ({inputs, backend}) => {\n const {image} = inputs as FlipLeftRightInputs;\n const webglBackend = backend as MathBackendWebGL;\n const program = new FlipLeftRightProgram((image as Tensor4D).shape);\n const output = webglBackend.runWebGLProgram(program, [image], image.dtype);\n return output;\n };\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====
*\n\nimport {FloorDiv, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\n// We use native integer division to deal with floating point imprecision.
Since we implement floor division and glsl implements truncated division, we correct for this by subtracting 1 from result when the result is negative and there is a remainder.\nconst INT_DIV = `float s = sign(a) * sign(b);\n\nint ia = round(a);\nint ib = round(b);\nif (ib != 0) {\n // Windows (D3D) wants guaranteed non-zero int division at compile-time.\n return float(idiv(ia, ib, s));\n} else {\n return NAN;\n}`;\n\nconst INT_DIV_PACKED = `\n ivec4 ia = round(a);\n ivec4 ib = round(b);\n bvec4 cond = notEqual(ib, ivec4(0));\n ivec4 result = ivec4(0);\n vec4 s = sign(a) * sign(b);\n\n // Windows (D3D) wants guaranteed non-zero int division at compile-time.\n if (cond[0]) {\n result[0] = idiv(ia[0], ib[0], s[0]);\n }\n if (cond[1]) {\n result[1] = idiv(ia[1], ib[1], s[1]);\n }\n if (cond[2]) {\n result[2] = idiv(ia[2], ib[2], s[2]);\n }\n if (cond[3]) {\n result[3] = idiv(ia[3], ib[3], s[3]);\n }\n return vec4(result);\n`;\n\nexport const floorDiv = binaryKernelFunc({opSnippet: INT_DIV, packedOpSnippet: INT_DIV_PACKED, dtype: 'int32'});\n\nexport const floorDivConfig: KernelConfig = {\n kernelName: FloorDiv,\n backendName: 'webgl',\n kernelFunc: floorDiv\n};\n\nas { } as KernelFunc;\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====
*\n\nimport {getGslDifferences} from './../gsl_version';\nimport {GPGPUProgram} from './../gpgpu_math';\n\nexport class FromPixelsProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(outputShape: number[]) {\n const gsl = getGslDifferences();\n const [height, width,] = outputShape;\n this.outputShape = outputShape;\n this.userCode = `\n void main() {\n ivec3 coords = getOutputCoords();\n int texR = coords[0];\n int texC = coords[1];\n int depth = coords[2];\n vec2 uv = (vec2(texC, texR) + halfCR) /`
```

```
vec2($ {width}.0, $ {height}.0);\n\n vec4 values = $ {glsl.texture2D}(A, uv);\n float value;\n if (depth == 0) {\n value = values.r;\n } else if (depth == 1) {\n value = values.g;\n } else if (depth == 2) {\n value = values.b;\n } else if (depth == 3) {\n value = values.a;\n }\n\n setOutput(floor(value * 255.0 + 0.5));\n }\n\n`;\n}\n}\n}\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC.\n * All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
```

```
compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {getGlslDifferences} from './../glsl_version';\nimport {GPGPUProgram} from './../gpgpu_math';\n\nexport class FromPixelsPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = false;\n packedOutput = true;\n\n constructor(outputShape: number[]) {\n const glsl = getGlslDifferences();\n const [height, width,] = outputShape;\n this.outputShape = outputShape;\n\n this.userCode = `\n void main() {\n ivec3 coords = getOutputCoords();\n int texR = coords[0];\n int texC = coords[1];\n int depth = coords[2];\n\n vec4 result = vec4(0.);\n for(int row=0; row<=1; row++) {\n for(int col=0; col<=1; col++) {\n texC = coords[1] + row;\n depth = coords[2] + col;\n\n vec2 uv = (vec2(texC, texR) + halfCR) ^\n vec2($ {width}.0, $ {height}.0);\n vec4 values = $ {glsl.texture2D}(A, uv);\n float value;\n if (depth == 0) {\n value = values.r;\n } else if (depth == 1) {\n value = values.g;\n } else if (depth == 2) {\n value = values.b;\n } else if (depth == 3) {\n value = values.a;\n }\n\n result[row * 2 + col] = floor(value * 255.0 + 0.5);\n }\n }\n\n $ {glsl.output} = result;\n }\n\n`;\n }\n}\n}\n}\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {FromPixels, FromPixelsAttrs, FromPixelsInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {TextureUsage} from './tex_util';\nimport {FromPixelsProgram} from './FromPixels_utils/from_pixels_gpu';\nimport {FromPixelsPackedProgram} from './FromPixels_utils/from_pixels_packed_gpu';\n\nexport const fromPixelsConfig: KernelConfig = {\n kernelName: FromPixels,\n backendName: 'webgl',\n kernelFunc: fromPixels as { } as KernelFunc,\n};\n\nlet fromPixels2DContext: CanvasRenderingContext2D;\n\nfunction fromPixels(args: {\n inputs: FromPixelsInputs,\n backend: MathBackendWebGL,\n attrs: FromPixelsAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n let {pixels} = inputs;\n const {numChannels} = attrs;\n\n const isVideo = typeof (HTMLVideoElement) !== 'undefined' &&\n pixels instanceof HTMLVideoElement;\n const isImage = typeof (HTMLImageElement) !== 'undefined' &&\n pixels instanceof HTMLImageElement;\n const isImageBitmap = typeof (ImageBitmap) !== 'undefined' &&\n pixels instanceof ImageBitmap;\n const [width, height] = isVideo ?\n [\n (pixels as HTMLVideoElement).videoWidth,\n (pixels as HTMLVideoElement).videoHeight\n] :\n [pixels.width, pixels.height];\n\n const texShape: [number, number] = [height, width];\n const outShape = [height, width, numChannels];\n\n if (isImage || isVideo ||
```

```

isImageBitmap) {\n if (fromPixels2DContext == null) {\n fromPixels2DContext =
document.createElement('canvas').getContext('2d');\n }\n fromPixels2DContext.canvas.width = width;\n fromPixels2DContext.canvas.height = height;\n fromPixels2DContext.drawImage(\n pixels as
HTMLVideoElement | HTMLImageElement | ImageBitmap,\n 0, 0, width, height);\n pixels =
fromPixels2DContext.canvas;\n }\n const tempPixelHandle = backend.makeTensorInfo(texShape, 'int32');\n //
This is a byte texture with pixels.\n backend.texData.get(tempPixelHandle.dataId).usage =
TextureUsage.PIXELS;\n backend.gpgpu.uploadPixelDataToTexture(\n
backend.getTexture(tempPixelHandle.dataId), pixels as ImageData);\n const program
= env().getBool('WEBGL_PACK') ?\n new FromPixelsPackedProgram(outShape) :\n new
FromPixelsProgram(outShape);\n const res = backend.runWebGLProgram(program, [tempPixelHandle], 'int32');\n
backend.disposeData(tempPixelHandle.dataId);\n return res;\n}\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport
{ backend_util, env, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport
{ Conv2DProgram } from '../conv_gpu';\n\nimport { mapActivationToShaderProgram } from
'./kernel_utils/kernel_funcs_utils';\n\nimport { conv2dByMatMul, conv2dWithIm2Row } from
'./Conv2D_impl';\n\nimport { reshape } from './Reshape';\n\nexport function fusedConv2d(args: {\n inputs:
FusedConv2DInputs,\n attrs: FusedConv2DAttrs,\n backend: MathBackendWebGL\n}) {\n const { inputs,
backend, attrs } = args;\n const { x, filter, bias, preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n dataFormat,\n dilations,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const
$dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape
as [number, number, number, number], strides, dilations, pad,\n dimRoundingMode, false /* depthwise */,\n $dataFormat);\n let out: TensorInfo;\n const intermediates: TensorInfo[] = [];\n\n if (convInfo.filterHeight === 1
&& convInfo.filterWidth === 1 && convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 && convInfo.strideHeight === 1 && convInfo.strideWidth === 1 && (convInfo.padInfo.type === 'SAME' ||
convInfo.padInfo.type === 'VALID')) {\n out = conv2dByMatMul({\n x,\n filter,\n convInfo,\n backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n } else if
(env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\n out = conv2dWithIm2Row({\n x,\n filter,\n convInfo,\n backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n } else {\n const hasBias = bias != null;\n const hasPreluActivationWeights
= preluActivationWeights != null;\n const hasLeakyreluAlpha = activation === 'leakyrelu';\n const
fusedActivation =\n activation ? mapActivationToShaderProgram(activation, false) : null;\n const program =
new Conv2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n hasLeakyreluAlpha);\n const inputs: TensorInfo[] = [x, filter];\n if (bias) {\n inputs.push(bias);\n }\n if
(preluActivationWeights) {\n inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32', 'float32'));\n inputs.push($leakyreluAlpha);\n intermediates.push($leakyreluAlpha);\n }\n out = backend.runWebGLProgram(program, inputs, 'float32');\n }\n\n const outReshaped =\n reshape({inputs: {x: out}, backend, attrs: {shape: convInfo.outShape}});\n\n intermediates.push(out);\n

```

```

intermediates.forEach(t => backend.disposeIntermediateTensorInfo(t));\n\n return outReshaped;\n}\n\nexport
const fusedConv2DConfig: KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'webgl',\n
kernelFunc: fusedConv2d as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport
{ backend_util, env, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { DepthwiseConv2DProgram } from './conv_gpu_depthwise';\n\nimport
{ DepthwiseConvPacked2DProgram } from './conv_packed_gpu_depthwise';\n\nimport
{ mapActivationToShaderProgram } from './kernel_utils/kernel_funcs_utils';\n\nexport function
fusedDepthwiseConv2D(args: {\n inputs: FusedDepthwiseConv2DInputs,\n attrs: FusedDepthwiseConv2DAttrs,\n
backend: MathBackendWebGL\n}) {\n const { inputs, backend, attrs } = args;\n const { x, filter, bias,
preluActivationWeights } = inputs;\n const { strides, pad, dilations, dimRoundingMode, activation, leakyreluAlpha }
=\n attrs;\n\n const intermediates: TensorInfo[] = [];\n\n let $dilations = dilations;\n if ($dilations == null) {\n
$dilations = [1, 1];\n }\n\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides,
$dilations),\n () => 'Error in depthwiseConv2d: Either strides or dilations must be ' +\n `1. Got strides
${strides} and dilations '${dilations}');\n\n const convInfo = backend_util.computeConv2DInfo(\n x.shape as
[number, number, number, number],\n filter.shape as [number, number, number, number], strides, $dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n const shouldPackDepthwiseConv =
env().getBool('WEBGL_PACK_DEPTHWISECONV') &&\n convInfo.strideWidth <= 2 &&\n
convInfo.outChannels / convInfo.inChannels === 1;\n\n const fusedActivation = activation ?\n
mapActivationToShaderProgram(activation, shouldPackDepthwiseConv) : \n null;\n\n const programInputs:
TensorInfo[] = [x, filter];\n\n const hasBias = bias != null;\n\n const hasPreluActivationWeights =
preluActivationWeights != null;\n\n const hasLeakyreluAlpha = activation === 'leakyrelu';\n\n if (hasBias) {\n
programInputs.push(bias);\n }\n\n if (hasPreluActivationWeights) {\n programInputs.push(preluActivationWeights);\n }\n\n if (hasLeakyreluAlpha)
{\n const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n
util.createScalarValue(leakyreluAlpha as { } as 'float32', 'float32'));\n programInputs.push($leakyreluAlpha);\n
intermediates.push($leakyreluAlpha);\n }\n\n let program:
DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n\n if (shouldPackDepthwiseConv) {\n program =
new DepthwiseConvPacked2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n
hasLeakyreluAlpha);\n } else {\n program = new DepthwiseConv2DProgram(\n convInfo, hasBias,
fusedActivation, hasPreluActivationWeights,\n hasLeakyreluAlpha);\n }\n\n const result =
backend.runWebGLProgram(program, programInputs, 'float32');\n\n intermediates.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n return result;\n}\n\nexport const fusedDepthwiseConv2DConfig:
KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName: 'webgl',\n kernelFunc:
fusedDepthwiseConv2D as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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governing permissions and\n * limitations under the License.\n *
=====
*\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'/shader_compiler';\n\nexport class GatherNDProgram implements
GPGPUProgram {\n variableNames = ['x', 'indices'];\n outputShape: number[];\n userCode: string;\n constructor(\n private sliceDim: number, private strides: number[], shape: number[]) {\n this.outputShape =
shape;\n const stridesType = getCoordsDataType(strides.length);\n const dtype =
getCoordsDataType(shape.length);\n const strideString = this.sliceDim > 1 ? 'strides[j]' : 'strides';\n this.userCode = `\n ${stridesType} strides = ${stridesType}(${this.strides});\n void main() {\n ${dtype} coords = getOutputCoords();\n int flattenIndex = 0;\n for (int j = 0; j < ${this.sliceDim}; j++)
{\n int index = round(getIndices(coords[0], j));\n flattenIndex += index * ${strideString};\n }\n setOutput(getX(flattenIndex, coords[1]));\n }\n `;\n }\n}\n\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, GatherNd, GatherNdInputs, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {GatherNDProgram}
from '../gather_nd_gpu';\nimport {reshape} from './Reshape';\n\nexport function gatherNd(\n args: {inputs:
GatherNdInputs, backend: MathBackendWebGL}): TensorInfo {\n const {inputs, backend}
= args;\n const {params, indices} = inputs;\n\n const indicesShape = indices.shape;\n const sliceRank =
indicesShape[indicesShape.length - 1];\n\n const [resultShape, numSlices, sliceSize, strides] =\nbackend_util.prepareAndValidate(params, indices);\n\n const flattenIndices = reshape(\n {inputs: {x: indices},
backend, attrs: {shape: [numSlices, sliceRank]}});\n const flattenX = reshape({\n inputs: {x: params},\n
backend, attrs: {shape: [(util.sizeFromShape(params.shape) / sliceSize), sliceSize]}\n });\n\n const program =\n new GatherNDProgram(sliceRank, strides, [numSlices, sliceSize]);\n const res = backend.runWebGLProgram(\n
program, [flattenX, flattenIndices], flattenX.dtype);\n const reshaped =\n reshape({inputs: {x: res}, backend,
attrs: {shape: resultShape}});\n\n backend.disposeIntermediateTensorInfo(flattenIndices);\n
backend.disposeIntermediateTensorInfo(flattenX);\n backend.disposeIntermediateTensorInfo(res);\n\n return
reshaped;\n}\n\nexport
const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'webgl',\n kernelFunc:
gatherNd as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'/shader_compiler';\n\nexport class
GatherProgram implements GPGPUProgram {\n variableNames = ['A', 'indices'];\n outputShape: number[];\n userCode: string;\n rank: number;\n\n constructor(aShape: number[], outputShape: number[]) {\n this.outputShape = outputShape;\n this.rank = outputShape.length;\n const dtype =
getCoordsDataType(this.rank);\n const sourceCoords = getSourceCoords(aShape, 2);\n\n this.userCode = `

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```
dtype: 'bool'\n});\n\nexport const greaterEqualConfig: KernelConfig = {\n kernelName: 'GreaterEqual',\n backendName: 'webgl',\n kernelFunc: 'greaterEqual as {} as KernelFunc'\n};\n\n"/**\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express\n * or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n\n*/\n\nimport {IFFT, IFFTInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {fftImpl} from './FFT_impl';\n\nexport function\n ifft(args: {inputs: IFFTInputs, backend: MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend} =\n args;\n const {input} = inputs;\n\n return fftImpl(input, true /* inverse */, backend);\n }\n\nexport const ifftConfig:\n KernelConfig = {\n kernelName: 'IFFT',\n backendName: 'webgl',\n kernelFunc: 'ifft'\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */
```

```
=====\n\n*/\n\nimport {IsFinite, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n '../kernel_utils/kernel_funcs_utils';\n\nconst IS_FINITE = `return float(!isnan(x) && !isinf(x));`\n\nexport const\n isFinite = unaryKernelFunc({opSnippet: IS_FINITE, dtype: 'bool'});\n\nexport const isFiniteConfig: KernelConfig\n = {\n kernelName: 'IsFinite',\n backendName: 'webgl',\n kernelFunc: 'isFinite'\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n *\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in\n * writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {IsInf, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n '../kernel_utils/kernel_funcs_utils';\n\nconst IS_INF = `return float(isinf(x));`\n\nexport const isInf =\n unaryKernelFunc({opSnippet: IS_INF, dtype: 'bool'});\n\nexport const isInfConfig: KernelConfig = {\n kernelName: 'IsInf',\n backendName: 'webgl',\n kernelFunc: 'isInf'\n};\n\n"/**\n * @license\n * Copyright 2020\n * Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {IsNan, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
```

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'./kernel_utils/kernel_funcs_utils';\n\nconst IS_NAN = `return float(isnan(x));`\n\nexport const isNaN =
unaryKernelFunc({opSnippet: IS_NAN, dtype: 'bool'});\n\nexport const isNaNConfig: KernelConfig = {\n
kernelName: IsNaN,\n
 backendName: 'webgl',\n kernelFunc: isNaN,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, LessEqual} from '@tensorflow/tfjs-core';\n\nimport {binaryKernelFunc}
from './kernel_utils/kernel_funcs_utils';\n\nexport const LESS_EQUAL = `return float(a <= b);`\n\nexport const
LESS_EQUAL_PACKED
= `\n return vec4(lessThanEqual(a, b));`\n\n\nexport const lessEqual = binaryKernelFunc(\n {opSnippet:
LESS_EQUAL, packedOpSnippet: LESS_EQUAL_PACKED, dtype: 'bool'});\n\nexport const lessEqualConfig:
KernelConfig = {\n kernelName: LessEqual,\n backendName: 'webgl',\n kernelFunc: lessEqual as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, LinSpace, LinSpaceAttrs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {linSpaceImplCPU} from
'./kernel_utils/shared';\n\nexport function linSpace(\n args: {backend: MathBackendWebGL, attrs:
LinSpaceAttrs}): TensorInfo {\n const {backend, attrs} = args;\n const {start, stop, num} = attrs;\n\n // TODO:
Use CPU implementation due to the precision problem in Safari.\n const outVals = linSpaceImplCPU(start, stop,
num);\n return backend.makeTensorInfo([outVals.length, 'float32', outVals]);\n}\n\n\nexport const linSpaceConfig:
KernelConfig = {\n kernelName: LinSpace,\n backendName: 'webgl',\n kernelFunc: linSpace as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {KernelConfig, Log1p} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst LOG1P = `return log(1.0 + x);`\n\nexport const log1p =
unaryKernelFunc({opSnippet: LOG1P});\n\nexport const log1pConfig: KernelConfig = {\n kernelName: Log1p,\n
backendName: 'webgl',\n kernelFunc: log1p,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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```



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```
=====\n*\n\nimport {KernelConfig, KernelFunc, LogicalAnd} from '@tensorflow/tfjs-core';\nimport\n{binaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_AND = `return float(a >= 1.0 &&\nb >= 1.0);`\nconst LOGICAL_AND_PACKED = `\n return vec4(\n vec4(greaterThanEqual(a, vec4(1.0))) *\n vec4(greaterThanEqual(b, vec4(1.0))))\n`;\n\nexport const logicalAnd = binaryKernelFunc({\n opSnippet: LOGICAL_AND,\n packedOpSnippet: LOGICAL_AND_PACKED,\n dtype: 'bool'\n});\n\nexport\nconst logicalAndConfig: KernelConfig = {\n kernelName: LogicalAnd,\n backendName: 'webgl',\n kernelFunc:\n logicalAnd as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====\n\n
```

```
=====\n*\n\nimport {KernelConfig,\n LogicalNot} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_NOT = `return float(!(x >= 1.0));`\n\nexport const\nlogicalNot = unaryKernelFunc({opSnippet: LOGICAL_NOT});\n\nexport const logicalNotConfig: KernelConfig =\n{\n kernelName: LogicalNot,\n backendName: 'webgl',\n kernelFunc: logicalNot,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */\n\n
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, LogicalOr} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc}\nfrom './kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_OR = `return float(a >= 1.0 || b >= 1.0);`\n\nconst\nLOGICAL_OR_PACKED = `\n return min(\n vec4(greaterThanEqual(a, vec4(1.0))) +\n vec4(greaterThanEqual(b, vec4(1.0))),\n vec4(1.0))\n`;\n\nexport const logicalOr = binaryKernelFunc(\n{\n opSnippet: LOGICAL_OR, packedOpSnippet: LOGICAL_OR_PACKED, dtype: 'bool'\n});\n\nexport const\nlogicalOrConfig: KernelConfig = {\n kernelName: LogicalOr,\n backendName: 'webgl',\n kernelFunc: logicalOr\nas { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNProgram implements GPGPUProgram\n{\n variableNames = ['x'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n xShape:\n number[], radius: number, bias: number, alpha: number,\n beta: number) {\n const rad = radius;\n const\n maxD = xShape[3] - 1;\n this.outputShape = xShape;\n\n // optimize pow(bias + alpha * sum, -beta)\n // src:\n
```

```
https://github.com/tensorflow/tensorflow/.. \n // blob/26033a1644a9c4a5f5e3170ab2e864b6a4ccd4ca/.\n
// tensorflow/core/kernels/mkl_lrn_op.cc#L320 \n let powOperator; \n const basis = `float(${bias}) +
float(${alpha}) * sum`; \n if (beta === 0.5) { \n powOperator = `inversesqrt(${basis})`; \n } else if (beta ===
1.0) { \n powOperator = `1.0/(${basis})`; \n } else { \n powOperator = `exp(log(${basis}) * float(-
${beta}))`; \n } \n \n this.userCode = ` \n void main() { \n ivec4 coords = getOutputCoords(); \n int b =
coords[0]; \n int r = coords[1]; \n int c = coords[2]; \n int d = coords[3]; \n float x = getX(b, r, c, d); \n
float sum = 0.0; \n for (int j = -${rad}; j <= ${rad}; j++) { \n int idx = d + j; \n if (idx >= 0 && idx
<= ${maxD}) { \n float z = getX(b, r, c, idx); \n sum += z * z; \n } \n } \n float val = x *
${powOperator}; \n setOutput(val); \n } \n `; \n } \n } \n
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```
===== \n
* \n \n import { GPGPUProgram } from './gpgpu_math'; \n \n export class LRNPackedProgram implements
GPGPUProgram { \n variableNames = ['x']; \n outputShape: number[] = []; \n userCode: string; \n packedInputs =
true; \n packedOutput = true; \n \n constructor(\n xShape: number[], radius: number, bias: number, alpha:
number, \n beta:
number) { \n const rad = radius; \n const maxD = xShape[3] - 1; \n this.outputShape = xShape; \n \n // optimize
pow(bias + alpha * sum, -beta) \n // src: https://github.com/tensorflow/tensorflow/.. \n //
blob/26033a1644a9c4a5f5e3170ab2e864b6a4ccd4ca/.. \n // tensorflow/core/kernels/mkl_lrn_op.cc#L320 \n let
powOperator; \n const basis = `float(${bias}) + float(${alpha}) * sum`; \n if (beta === 0.5) { \n powOperator =
`inversesqrt(${basis})`; \n } else if (beta === 1.0) { \n powOperator = `1.0/(${basis})`; \n } else { \n
powOperator = `exp(log(${basis}) * float(-${beta}))`; \n } \n \n this.userCode = ` \n void main() { \n ivec4
coords = getOutputCoords(); \n int b = coords.x; \n int r = coords.y; \n int c = coords.z; \n int d =
coords.w; \n \n bool hasNextCol = d < ${this.outputShape[3]}; \n bool hasNextRow = c <
${this.outputShape[2]}; \n \n vec4 sum = vec4(0.); \n \n vec4 xFragAtOutputCoords =
getX(b, r, c, d); \n
vec4 xAtOutputCoords = vec4(\n getChannel(xFragAtOutputCoords, vec2(c, d)), \n
hasNextCol ? \n getChannel(xFragAtOutputCoords, vec2(c, d + 1)) : 0.0, \n hasNextRow ? \n
getChannel(xFragAtOutputCoords, vec2(c + 1, d)) : 0.0, \n (hasNextRow && hasNextCol) ? \n
getChannel(xFragAtOutputCoords, vec2(c + 1, d + 1)) : 0.0 \n); \n \n int firstChannel = d - ${rad}; \n
vec2 cache = vec2(0.); \n if (firstChannel >= 0) { \n vec4 firstChannelFrag = getX(b, r, c, firstChannel); \n
cache.x = getChannel(firstChannelFrag, vec2(c, firstChannel)); \n if (hasNextRow) { \n cache.y =
getChannel(firstChannelFrag, vec2(c + 1, firstChannel)); \n } \n } \n \n \n \n \n \n \n \n \n \n \n \n \n \n \n \n \n
ivec2 depth = ivec2(d, d + 1); \n for (int j = - ${rad}; j <= ${rad}; j++) { \n ivec2 idx = depth + j; \n
bvec2 aboveLowerBound =
greaterThanEqual(idx, ivec2(0)); \n
bvec2 belowUpperBound = lessThanEqual(idx, ivec2(${maxD})); \n \n bool depthInRange =
aboveLowerBound.x && belowUpperBound.x; \n bool depthPlusOneInRange = aboveLowerBound.y &&
belowUpperBound.y; \n \n if (depthInRange || depthPlusOneInRange) { \n vec4 z = vec4(0.); \n \n \n \n \n \n \n \n
xFragAtCurrentDepth; \n z.xz = cache.xy; \n if (depthPlusOneInRange && hasNextCol) { \n
xFragAtCurrentDepth = idx.y != d ? \n getX(b, r, c, idx.y) : xFragAtOutputCoords; \n \n \n \n \n \n \n \n \n \n \n
z.y =
getChannel(xFragAtCurrentDepth, vec2(c, idx.y)); \n if (hasNextRow) { \n z.w =
getChannel(xFragAtCurrentDepth, vec2(c + 1, idx.y)); \n } \n } \n \n \n \n \n \n \n \n \n \n \n \n \n \n \n \n \n
cache.xy = z.yw; \n sum += z * z; \n } \n } \n
vec4 result = xAtOutputCoords * ${powOperator}; \n setOutput(result); \n
} \n `; \n } \n } \n
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```

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```
=====\n*\n\nimport {env, KernelConfig, KernelFunc, LRN, LRNAttrs, LRNInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {LRNProgram} from '../lrn_gpu';\nimport {LRNPackedProgram} from '../lrn_packed_gpu';\n\nexport const lrn = (args: {inputs: LRNInputs, backend: MathBackendWebGL, attrs: LRNAttrs}):\n TensorInfo => {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {depthRadius, bias, alpha, beta} = attrs;\n\n const program =\n env().getBool('WEBGL_PACK_NORMALIZATION') ?\n new LRNPackedProgram(x.shape, depthRadius, bias, alpha, beta) :\n new LRNProgram(x.shape, depthRadius, bias, alpha, beta);\n\n return backend.runWebGLProgram(program, [x], x.dtype);\n };\n\n// tslint:disable-next-line: variable-name\nexport const LRNConfig: KernelConfig = {\n kernelName: LRN,\n backendName: 'webgl',\n kernelFunc: lrn as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {GPGPUProgram} from '../gpgpu_math';\n\nexport class LRNGradProgram implements GPGPUProgram {\n variableNames = ['inputImage', 'outputImage', 'dy'];\n outputShape: number[] = [];\n userCode: string;\n depthRadius: number;\n bias: number;\n alpha: number;\n beta: number;\n depth: number;\n\n constructor(\n inputShape: number[], depthRadius: number, bias: number, alpha: number, beta: number) {\n this.outputShape = inputShape;\n this.depth = inputShape[3];\n this.depthRadius = depthRadius;\n this.bias = bias;\n this.alpha = alpha;\n this.beta = beta;\n this.userCode\n }\n\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int r = coords[1];\n int c = coords[2];\n\n float result = 0.0;\n for (int d = 0; d < ${this.depth}; ++d) {\n int depthBegin = int(max(0.0, float(d - ${depthRadius}));\n int depthEnd = int(min(float(${this.depth}), float(d + ${depthRadius} + 1));\n\n const int MIN_DEPTH_BEGIN = 0;\n const int MAX_DEPTH_END = ${this.depth};\n\n float norm = 0.0;\n for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END; ++k) {\n if (k < depthBegin) {\n continue;\n } else if (k >= depthBegin && k < depthEnd) {\n norm += getInputImage(b, r, c, k) * getInputImage(b, r, c, k);\n } else {\n break;\n }\n }\n\n norm = float(${alpha}) * norm + float(${bias});\n\n for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END; ++k) {\n if (k < depthBegin) {\n continue;\n } else if (k >= depthBegin && k < depthEnd) {\n float dyi = -2.0 * float(${alpha}) * float(${beta}) * getInputImage(b, r, c, k) * getOutputImage(b, r, c, d) / norm;\n if (k == d) {\n dyi += pow(norm, -1.0 * ${beta});\n }\n if (k == coords[3]) {\n dyi *= getDy(b, r, c, d);\n }\n result += dyi;\n } else {\n break;\n }\n }\n\n setOutput(result);\n }\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n */
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```
=====
*import { KernelConfig, KernelFunc, LRNGrad, LRNGradAttrs, LRNGradInputs, TensorInfo } from
'@tensorflow/tfjs-core';import { MathBackendWebGL } from './backend_webgl';import { LRNGradProgram }
from './lrn_grad_gpu';export const lrnGrad = (args: { inputs: LRNGradInputs, backend:
MathBackendWebGL, attrs: LRNGradAttrs }): TensorInfo => { const { inputs, backend, attrs } = args; const
{ x, y, dy } = inputs; const { depthRadius, bias, alpha, beta } = attrs; const program = new
LRNGradProgram(x.shape, depthRadius, bias, alpha, beta);
 return backend.runWebGLProgram(program, [x, y, dy], x.dtype);};
// tslint:disable-next-line: variable-name
export const LRNGradConfig: KernelConfig = { kernelName: LRNGrad, backendName: 'webgl',
kernelFunc: lrnGrad as { } as KernelFunc };
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 */
=====
*import { KernelFunc,
 Max, MaxAttrs, MaxInputs, TensorInfo } from '@tensorflow/tfjs-core';import { backend_util, KernelConfig,
 TypedArray, util } from '@tensorflow/tfjs-core';import { MathBackendWebGL } from
 './backend_webgl';import { maxImplCPU } from './kernel_utils/shared';import { maxImpl } from
 './Max_impl';import { transposeImpl, transposeImplCPU } from './Transpose_impl';export function max(
 args: { inputs: MaxInputs, backend: MathBackendWebGL, attrs: MaxAttrs }): TensorInfo { const { inputs,
 backend, attrs } = args; const { x } = inputs; const { reductionIndices, keepDims } = attrs; const xRank =
 x.shape.length; const origAxes = util.parseAxisParam(reductionIndices, x.shape); let axes = origAxes;
 const permutedAxes = backend_util.getAxesPermutation(axes, xRank); const maxInputIsTransposed =
 permutedAxes !== null; const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([x]); let maxInput =
 x; if (maxInputIsTransposed) { if (shouldExecuteOnCPU) { const xTexData = backend.texData.get(maxInput.dataId);
 const values = xTexData.values as TypedArray; const newShape: number[] = new Array(xRank); for (let i = 0; i < newShape.length; i++) {
 newShape[i] = x.shape[permutedAxes[i]]; } const maxInputValues =
 transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape); maxInput =
 backend.makeTensorInfo(newShape, x.dtype); const maxInputData = backend.texData.get(maxInput.dataId);
 maxInputData.values = maxInputValues; } else { maxInput = transposeImpl(x, permutedAxes,
 backend); } axes = backend_util.getInnerMostAxes(axes.length, xRank); } backend_util.assertAxesAreInnerMostDims('max', axes, xRank);
 const [maxOutShape, reduceShape] =
 backend_util.computeOutAndReduceShapes(maxInput.shape, axes); let outShape = maxOutShape; if
 (keepDims) { // rather than reshape at the end, set the target
 shape here. outShape = backend_util.expandShapeToKeepDim(maxOutShape, origAxes); } let out; if
 (shouldExecuteOnCPU) { const xTexData = backend.texData.get(maxInput.dataId); const values =
 xTexData.values as TypedArray; const outValues = maxImplCPU(values,
 util.sizeFromShape(reduceShape), outShape, x.dtype); out = backend.makeTensorInfo(outShape, x.dtype);
 const outData = backend.texData.get(out.dataId); outData.values = outValues; } else { out =
```

```

maxImpl(maxInput, reduceShape, outShape, backend);\n }\n\n if (maxInputIsTransposed) {\n
backend.disposeIntermediateTensorInfo(maxInput);\n }\n\n return out;\n}\n\nexport const maxConfig:
KernelConfig = {\n kernelName: Max,\n backendName: 'webgl',\n kernelFunc: max as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*\nimport { backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, TensorInfo, util }
from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport
{ Pool2DProgram } from '../pool_gpu';\nimport { assertNotComplex } from '../webgl_util';\nimport { identity } from
'/Identity';\n\nexport function maxPool(args: {\n inputs: MaxPoolInputs,\n backend: MathBackendWebGL,\n
attrs: MaxPoolAttrs\n}): TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n assertNotComplex(x, 'maxPool');\n const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n const dilations = 1;\n\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => 'Error in maxPool: Either strides or
dilations must be 1. ' +\n `Got strides ${strides} and dilations '${dilations}');\n\n const convInfo =
backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize, strides,\n
dilations, pad, dimRoundingMode);\n if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1 &&\n
util.arraysEqual(convInfo.inShape, convInfo.outShape)) {\n return identity({inputs: {x}, backend});\n }\n const
maxPoolProgram = new Pool2DProgram(convInfo, 'max', false);\n return
backend.runWebGLProgram(maxPoolProgram, [x], x.dtype);\n}\n\nexport const maxPoolConfig: KernelConfig =
{\n kernelName: MaxPool,\n backendName: 'webgl',\n
kernelFunc: maxPool as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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=====\n
*\nimport { backend_util, KernelConfig, KernelFunc, MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport
{ Pool3DProgram } from '../pool_gpu';\n\nexport
function maxPool3d(args: {\n inputs: MaxPool3DInputs,\n backend: MathBackendWebGL,\n attrs:
MaxPool3DAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const
{filterSize, strides, pad, dataFormat, dimRoundingMode} = attrs;\n const dilations: [number, number, number] = [1,
1, 1];\n\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number, number, number, number,
number], filterSize, strides,\n dilations, pad, dimRoundingMode, dataFormat);\n const maxPoolProgram = new
Pool3DProgram(convInfo, 'max', false);\n return backend.runWebGLProgram(maxPoolProgram, [x],
x.dtype);\n}\n\nexport const maxPool3DConfig: KernelConfig = {\n kernelName: MaxPool3D,\n backendName:
'webgl',\n kernelFunc: maxPool3d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC.
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```

=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class MaxPool2DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy', 'maxPos'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv2DInfo) {\n this.outputShape = convInfo.inShape;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight
= convInfo.dilationHeight;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padTop = effectiveFilterHeight - 1 -
convInfo.padInfo.top;\n const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n const lastIndex =
effectiveFilterHeight * effectiveFilterWidth - 1;\n this.userCode = `\n const ivec2 pads = ivec2(${padTop},
${padLeft});\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d =
coords[3];\n ivec2 dyRCCorner = coords.yz - pads;\n int dyRCorner = dyRCCorner.x;\n int
dyCCorner = dyRCCorner.y;\n // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n // ? =
to be determined. := across all values in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float
dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||
fract(dyR) > 0.0) {\n continue;\n }\n int idyR = int(dyR);\n for (int wC = 0; wC <
${effectiveFilterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n if
(dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC = int(dyC);\n float dyValue = getDy(b, idyR, idyC, d);\n int maxPosValue = ${lastIndex} -
int(getMaxPos(b, idyR, idyC, d));\n // Get the current value, check it against the value from the\n //
position matrix.\n int curPosValue = wR * ${effectiveFilterWidth} + wC;\n float mask =
float(maxPosValue == curPosValue ? 1.0 : 0.0);\n dotProd += dyValue * mask;\n }\n }\n setOutput(dotProd);\n }\n `;\n}\n\n}\n\nexport class MaxPool3DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy', 'maxPos'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.inShape;\n const strideDepth =
convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterDepth =
convInfo.effectiveFilterDepth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padFront = effectiveFilterDepth - 1 -
convInfo.padInfo.front;\n const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft =
effectiveFilterWidth - 1 - convInfo.padInfo.left;\n const lastIndex
= effectiveFilterDepth * effectiveFilterHeight * effectiveFilterWidth - 1;\n this.userCode = `\n const
ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n void main() {\n ivec5 coords =
getOutputCoords();\n int batch = coords.x;\n int ch = coords.u;\n ivec3 dyCorner = ivec3(coords.y,
coords.z, coords.w) - pads;\n int dyDCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int
dyCCorner = dyCorner.z;\n // Convolve dy(?, ?, ?, ch) with pos mask(:, :, :, d) to get\n // dx(xD, xR, xC,
ch).\n // ? = to be determined. := across all values in that axis.\n float dotProd = 0.0;\n for (int wD =
0; wD < ${effectiveFilterDepth};\n wD += ${dilationDepth}) {\n float dyD = float(dyDCorner + wD) /
${strideDepth}.0;\n if (dyD < 0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD) > 0.0) {\n continue;\n }\n int idyD = int(dyD);\n `;

```

```

 for (int wR = 0; wR < ${effectiveFilterHeight});\n wR += ${dilationHeight}) {\n float dyR =
float(dyRCorner + wR) / ${strideHeight}.0;\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||\n
fract(dyR) > 0.0) {\n continue;\n }\n int idyR = int(dyR);\n for (int wC = 0; wC <
${effectiveFilterWidth});\n wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) /
${strideWidth}.0;\n if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n
 continue;\n }\n int idyC = int(dyC);\n float dyValue = getDy(batch, idyD, idyR,
idyC, ch);\n int maxPosValue = ${lastIndex} -\n int(getMaxPos(batch, idyD, idyR, idyC,
ch));\n // Get the current value, check it against the value from the\n // position matrix.\n
 int curPosValue =\n wD * ${effectiveFilterHeight} * ${effectiveFilterWidth} +\n wR
* ${effectiveFilterWidth} + wC;\n float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0);\n
dotProd += dyValue * mask;\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n
}\n}\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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```

```

=====\n
*/\nimport {backend_util, KernelConfig, KernelFunc, MaxPool3DGrad, MaxPool3DGradAttrs,
MaxPool3DGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {MaxPool3DBackpropProgram} from './max_pool_backprop_gpu';\nimport
{Pool3DProgram} from './pool_gpu';\n\nexport function maxPool3DGrad(args: {\n inputs:
MaxPool3DGradInputs,\n backend: MathBackendWebGL,\n attrs: MaxPool3DGradAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {dy, input} = inputs;\n const x = input;\n const {filterSize, strides,
pad, dimRoundingMode} = attrs;\n const dilations: [number, number, number] = [1, 1, 1];\n\n const convInfo =
backend_util.computePool3DInfo(\n x.shape as [number, number, number, number, number], filterSize, strides,\n
dilations, pad, dimRoundingMode);\n\n const maxPool3dPositionsProgram =\n new Pool3DProgram(convInfo, 'max', true /* get positions */);\n const maxPool3dPositions =\n backend.runWebGLProgram(maxPool3dPositionsProgram, [x], x.dtype);\n const maxPoolBackpropProgram = new
MaxPool3DBackpropProgram(convInfo);\n const result = backend.runWebGLProgram(\n
maxPoolBackpropProgram, [dy, maxPool3dPositions], x.dtype);\n
backend.disposeIntermediateTensorInfo(maxPool3dPositions);\n return result;\n}\n\nexport const
maxPoolGrad3DConfig: KernelConfig = {\n kernelName: MaxPool3DGrad,\n backendName: 'webgl',\n
kernelFunc: maxPool3DGrad as {} as KernelFunc\n};\n\n"/**\n *
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KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *

```

```

=====\n
*/\nimport {backend_util, KernelConfig, KernelFunc, MaxPoolGrad, MaxPoolGradAttrs, MaxPoolGradInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport
{MaxPool2DBackpropProgram} from './max_pool_backprop_gpu';\nimport {Pool2DProgram} from
'./pool_gpu';\nimport {assertNotComplex} from './webgl_util';\n\nexport function maxPoolGrad(args: {\n inputs:
MaxPoolGradInputs,\n backend: MathBackendWebGL,\n attrs: MaxPoolGradAttrs\n}): TensorInfo {\n const

```

```

{inputs, backend, attrs} = args;\n const {dy, input, output} = inputs;\n const x = input;\n assertNotComplex([input,
output], 'maxPoolGrad');\n const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n\n const convInfo = backend_util.computePool2DInfo(\n x.shape as
[number, number, number, number], filterSize, strides,\n 1 /* dilations */, pad, dimRoundingMode);\n const
getPositions = true;\n const maxPoolPositionsProgram =\n new Pool2DProgram(convInfo, 'max',
getPositions);\n const maxPoolPositions: TensorInfo =\n
backend.runWebGLProgram(maxPoolPositionsProgram, [x], x.dtype);\n\n const maxPoolBackPropProgram = new
MaxPool2DBackpropProgram(convInfo);\n const result = backend.runWebGLProgram(\n
maxPoolBackPropProgram, [dy, maxPoolPositions], x.dtype);\n
backend.disposeIntermediateTensorInfo(maxPoolPositions);\n return result;\n}\n\nexport const
maxPoolGradConfig: KernelConfig = {\n kernelName: MaxPoolGrad,\n backendName: 'webgl',\n kernelFunc:
maxPoolGrad as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {Pool2DProgram} from './pool_gpu';\n\nexport function maxPoolWithArgmaxImpl(\n
x: TensorInfo, includeBatchInIndex: boolean,\n convInfo: backend_util.Conv2DInfo,\n backend:
MathBackendWebGL): TensorInfo[] {\n let program = new Pool2DProgram(convInfo, 'max', false);\n
const poolOutput = backend.runWebGLProgram(program, [x], 'float32');\n\n program = new
Pool2DProgram(convInfo, 'max', true, true, includeBatchInIndex);\n const indexOutput =
backend.runWebGLProgram(program, [x], 'float32');\n return [poolOutput, indexOutput];\n}\n", "/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport
{MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs, MaxPoolWithArgmaxInputs} from '@tensorflow/tfjs-
core';\nimport {backend_util, KernelConfig, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL}
from './backend_webgl';\n\nimport {maxPoolWithArgmaxImpl} from './MaxPoolWithArgmax_impl';\n\nexport
const maxPoolWithArgmaxConfig: KernelConfig = {\n kernelName: MaxPoolWithArgmax,\n backendName:
'webgl',\n kernelFunc: ({inputs, attrs, backend}) => {\n const {x} = inputs as MaxPoolWithArgmaxInputs;\n
const {filterSize, strides, pad, includeBatchInIndex} =\n attrs as { } as MaxPoolWithArgmaxAttrs;\n const
webglBackend = backend as MathBackendWebGL;\n\n util.assert(\n x.shape.length === 4,\n () => `Error
in maxPool: input must be rank 4 but got rank ${\n x.shape.length}`);\n const dilations: [number, number]
= [1, 1];\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in
maxPool: Either strides or dilations must be 1. '\n `Got strides ${strides} and dilations ${dilations}`);\n\n
const convInfo = backend_util.computePool2DInfo(\n x.shape as [number, number, number, number],
filterSize, strides,\n dilations, pad);\n\n const [result, indexes] =\n maxPoolWithArgmaxImpl(x,
includeBatchInIndex, convInfo, webglBackend);\n return [result, indexes];\n } as KernelFunc\n};\n", "/**\n *
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```



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```
=====\n*\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reduce} from './kernel_utils/reduce';\nimport {reshape} from './kernels/Reshape';\n\nexport function meanImpl(\n x: TensorInfo, reduceShape: number[], outShape: number[],\n backend: MathBackendWebGL): TensorInfo {\n const inSize = util.sizeFromShape(reduceShape);\n const xSize = util.sizeFromShape(x.shape);\n const batchSize = xSize / inSize;\n const reshapedInput =\n reshape({inputs: {x}, attrs: {shape: [batchSize, inSize]}, backend});\n const reduced = reduce(reshapedInput, 'float32', 'mean', backend);\n const reshapedOutput =\n reshape({inputs: {x: reduced}, attrs: {shape: outShape}, backend});\n backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n\n return reshapedOutput;\n}\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {backend_util, KernelConfig, Mean, MeanAttrs, MeanInputs, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {meanImpl} from './Mean_impl';\nimport {transposeImpl, transposeImplCPU} from './Transpose_impl';\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'webgl',\n kernelFunc: ({inputs, attrs, backend}) => {\n const {x} = inputs as MeanInputs;\n const {keepDims, axis} = attrs as { } as MeanAttrs;\n const webglBackend = backend as MathBackendWebGL;\n\n const xRank = x.shape.length;\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const meanInputIsTransposed = permutedAxes != null;\n const shouldExecuteOnCPU = webglBackend.shouldExecuteOnCPU([x]);\n\n const intermediates: TensorInfo[] = [];\n let meanInput = x;\n if (meanInputIsTransposed) {\n if (shouldExecuteOnCPU) {\n const xTexData = webglBackend.texData.get(meanInput.dataId);\n const values = xTexData.values as TypedArray;\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[permutedAxes[i]];\n }\n const meanInputValues =\n transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);\n meanInput = webglBackend.makeTensorInfo(newShape, x.dtype);\n const meanInputData = webglBackend.texData.get(meanInput.dataId);\n meanInputData.values = meanInputValues;\n } else {\n meanInput = transposeImpl(x, permutedAxes, webglBackend);\n }\n intermediates.push(meanInput);\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('sum', axes, xRank);\n const [meanOutShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(meanInput.shape, axes);\n let outShape = meanOutShape;\n if (keepDims) {\n // rather than reshape at the end, set the target shape here.\n outShape =\n backend_util.expandShapeToKeepDim(meanOutShape,
```

```

origAxes);\n }\n\n const out = meanImpl(meanInput, reduceShape, outShape, WebGLBackend);\n for (const i
of intermediates) {\n WebGLBackend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n }\n};\n", "/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, Min,
MinAttrs, MinInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { reduce } from './kernel_utils/reduce';\n\nimport { reshape } from './Reshape';\n\nimport
{ transpose } from './Transpose';\n\n\nexport function min(\n args: { inputs: MinInputs, backend:
MathBackendWebGL, attrs: MinAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } =
inputs;\n const { axis, keepDims } = attrs;\n\n const xRank = x.shape.length;\n\n const origAxes =
util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n if (permutedAxes != null) {\n
permutedX = transpose({ inputs: { x }, backend, attrs: { perm: permutedAxes } });\n axes =
backend_util.getInnerMostAxes(axes.length, x.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims('min', axes, xRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(permutedX.shape,
axes);\n const inSize = util.sizeFromShape(reduceShape);\n const a2D =\n reshape({ inputs: { x: permutedX },
backend, attrs: { shape: [-1, inSize] } });\n const reduced = reduce(a2D, a2D.dtype, 'min', backend);\n let res;\n if
(keepDims) {\n const newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n res =
reshape({ inputs: { x: reduced }, backend, attrs: { shape: newShape } });\n } else {\n res = reshape({ inputs: { x:
reduced }, backend, attrs: { shape: outShape } });\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n
backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes != null) {\n
backend.disposeIntermediateTensorInfo(permutedX);\n }\n\n return res;\n }\n\n\nexport const minConfig:
KernelConfig = {\n kernelName: Min,\n backendName: 'webgl',\n kernelFunc: min as { } as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```

```

=====
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nimport { getCoordsDataType } from
'./shader_compiler';\n\n\nexport class MirrorPadProgram implements GPGPUProgram {\n variableNames = ['x'];\n
outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[], paddings: Array<[number,
number]>,\n mode: 'reflect'|'symmetric') {\n this.outputShape = paddings.map(\n (p,
i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n const rank = xShape.length;\n const dtype =
getCoordsDataType(rank);\n\n const start = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i)
=> p[0] + xShape[i]).join(',');\n const unpackedCoords =\n ['coords[0]', 'coords[1]', 'coords[2]',
'coords[3]'].slice(0, rank);\n const offset = mode === 'reflect' ? 0 : 1;\n\n if (rank === 1) {\n this.userCode =
`\n int start = ${start};\n int end = ${end};\n void main() {\n int outC = getOutputCoords();\n
 if (outC < start) {\n outC = start * 2 - outC - ${offset};\n } else if (outC >= end) {\n outC =
(end - 1) * 2 - outC + ${offset};\n }\n setOutput(getX(outC - start));\n }\n `;\n return;\n }\n

```

```

this.userCode = `
 ${dtype} start = ${dtype}(${start});
 ${dtype} end = ${dtype}(${end});
 void
main() {
 ${dtype} outC = getOutputCoords();
 for (int i = 0; i < ${rank}; i++) {
 if (outC[i] < start[i]) {
 outC[i] = start[i] * 2 - outC[i] - ${offset};
 } else if (outC[i] >= end[i]) {
 outC[i] = (end[i] - 1) * 2 -
outC[i] + ${offset};
 }
 }
 ${dtype} coords = outC - start;
setOutput(getX(${unpackedCoords}));
}
`;
}
}
`/**
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 *
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 * OR CONDITIONS OF ANY KIND, either express or implied.
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 */
=====
*/
import {GPGPUProgram} from './gpgpu_math';
import {getChannels} from './packing_util';
import
{getCoordsDataType} from './shader_compiler';
/**
 * Example shader code for
 * `mirrorPad(tf.tensor1d([1,
 * 2, 3], 'int32'), [[2, 2]], 'reflect')`
 */
const int start = int(2);
const int end = int(5);
void main()
{
 int outputLoc = getOutputCoords();
 vec4 result = vec4(0.);
 int rc = outputLoc;
 int source = rc;
 if (source < start) {
 source = start * 2 - source - 0;
 } else if (source >= end)
{
 source = (end - 1) * 2 - source + 0;
 }
 source -= start;
 result[0] =
getChannel(getX(source), source);
 rc += 1;
 if (rc < 6) {
 int source = rc;
 if (source <
start)
{
 source = start * 2 - source - 0;
 } else if (source >= end) {
 source = (end - 1) * 2 -
source + 0;
 }
 source -= start;
 result[1] = getChannel(getX(source), source);
 }
 setOutput(result);
}
}
export class MirrorPadPackedProgram implements
GPGPUProgram {
 variableNames = ['x'];
 packedInputs = true;
 packedOutput = true;
 outputShape:
number[];
 userCode: string;
 constructor(xShape: number[], paddings: Array<[number, number]>,
mode: 'reflect'|'symmetric') {
 this.outputShape = paddings.map((p, i) => p[0] /* beforePad */ + xShape[i]
+ p[1] /* afterPad */);
 const rank = xShape.length;
 const dtype = getCoordsDataType(rank);
 const start
= paddings.map(p => p[0]).join(',');
 const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');
 const
coords = getChannels('rc', rank);
 const source
= getChannels('source', rank);
 const cLimit = `${coords[rank - 1]} < ${this.outputShape[rank - 1]}`;
 const innerDims =
rank === 1 ? 'source': `vec2(${source.slice(-2).join()})`;
 const offset = mode === 'reflect' ?
0 : 1;
 let mainLoop = `
if (rank === 1) {
 const padSetup = `
 ${dtype} source = rc;
 if
(source < start) {
 source = start * 2 - source - ${offset};
 } else if (source >= end) {
 source =
(end - 1) * 2 - source + ${offset};
 }
 source -= start;
 `;
 mainLoop = `
 ${dtype} rc =
outputLoc;
 ${padSetup}
 result[0] = getChannel(getX(${source.join()}), ${innerDims});
 ${coords[rank - 1]} += 1;
 if (${cLimit}) {
 ${padSetup}
 result[1] =
getChannel(getX(${source.join()}), ${innerDims});
 }
 `;
 } else {
 const padSetup = `
 ${dtype} source = rc;
 ${dtype} lt = ${dtype}(lessThan(source,
start));
 ${dtype} gte = ${dtype}(greaterThanEqual(source, end));
 ${dtype} orig = 1 - (lt + gte);
 source = orig * source +
 lt * (start * 2 - source - ${offset}) +
 gte * ((end - 1) * 2 - source +
${offset});
 source -= start;
 `;
 mainLoop = `
 ${dtype} rc = outputLoc;
 ${padSetup}
 result[0] = getChannel(getX(${source.join()}), ${innerDims});
 ${coords[rank - 1]} += 1;
 if (${cLimit}) {
 ${padSetup}
 result[1] = getChannel(getX(${source.join()}), ${innerDims});
 }
 rc = outputLoc;
 ${coords[rank - 2]} += 1;
 if (${coords[rank - 2]} < ${this.outputShape[rank -
2]}) {
 ${padSetup}
 result[2] = getChannel(getX(${source.join()}), ${innerDims});
 }
 ${coords[rank - 1]} += 1;
 if (${cLimit}) {
 ${padSetup}
 result[3] =
`

```

```

getChannel(getX(${source.join()}),
 ${innerDims});\n }\n }\n `;\n }\n this.userCode = `\n const ${dtype} start =
${dtype}(${start});\n const ${dtype} end = ${dtype}(${end});\n void main() {\n ${dtype} outputLoc =
getOutputCoords();\n vec4 result = vec4(0.);\n ${mainLoop}\n setOutput(result);\n }\n `;\n
}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {env, KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs, TensorInfo} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {MirrorPadProgram}
from '../mirror_pad_gpu';\n\nimport {MirrorPadPackedProgram} from '../mirror_pad_packed_gpu';\n\nexport const
mirrorPadKernelFunc: (params: {\n inputs: MirrorPadInputs,\n backend: MathBackendWebGL,\n attrs:
MirrorPadAttrs\n}) => TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {paddings,
mode} = attrs;\n\n const program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new
MirrorPadPackedProgram(x.shape, paddings, mode) :\n new MirrorPadProgram(x.shape, paddings, mode);\n\n const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n return output;\n};\n\nexport const
mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName:
'webgl',\n kernelFunc: mirrorPadKernelFunc as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {KernelConfig, KernelFunc, Mod} from '@tensorflow/tfjs-core';\n\nimport
{CHECK_NAN_SNIPPET} from '../binaryop_packed_gpu';\n\nimport {binaryKernelFunc} from
'../kernel_utils/kernel_funcs_utils';\n\nconst
MOD = `if (b == 0.0) return NaN;\n return mod(a, b);`;\n\nconst MOD_PACKED = `\n vec4 result = mod(a, b);\n
vec4 isNaN = vec4(equal(b, vec4(0.0))); \n +\n CHECK_NAN_SNIPPET +`\n return result;\n`;\n\nexport const
mod = binaryKernelFunc({\n opSnippet: MOD,\n packedOpSnippet: MOD_PACKED,\n});\n\nexport const
modConfig: KernelConfig = {\n kernelName: Mod,\n backendName: 'webgl',\n kernelFunc: mod as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class MultinomialProgram implements GPGPUProgram {\n variableNames = ['probs'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for speed.\n seedLoc: WebGLUniformLocation;\n\n constructor(batchSize: number, numOutcomes: number, numSamples: number) {\n this.outputShape = [batchSize,
numSamples];\n\n this.userCode = `\n uniform float seed;\n void main() {\n ivec2 coords =

```

```

getOutputCoords();\n int batch = coords[0];\n float r = random(seed);\n float cdf = 0.0;\n for
(int i = 0; i < ${numOutcomes - 1}; i++) {\n cdf += getProbs(batch, i);\n if (r < cdf) {\n
setOutput(float(i));\n return;\n
 }\n }\n // If no other event happened, last event happened.\n setOutput(float(${numOutcomes -
1}));\n }\n `;\n }\n getCustomSetupFunc(seed: number) {\n return (gpgpu: GPGPUContext,
webGLProgram: WebGLProgram) => {\n if (this.seedLoc == null) {\n this.seedLoc =
gpgpu.getUniformLocation(webGLProgram, 'seed');\n }\n gpgpu.gl.uniform1f(this.seedLoc, seed);\n };\n
}\n}\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {RealDiv} from '@tensorflow/tfjs-core';\nimport {KernelConfig} from '@tensorflow/tfjs-
core';\nimport {binaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\n// Without the equality check div
produces 0.9999 for a = b, which when\n// floored can cause errors.\nconst DIV = \nif (a == b) {\n return
1.0;\n};\nreturn a / b;\n\n// We do the same as in ./binaryop_gpu, with vec4 and ivec4.\n// On Linux, the vectorized
implementation produces NaNs when a and b are 0.\nconst DIV_PACKED = \n // vec4 one = vec4(equal(a, b));\n
// return one + (vec4(1.0) - one) * a / b;\n vec4 result = a / b;\n if(a.x == b.x) {\n result.x = 1.;\n }
if(a.y ==
b.y) {\n result.y = 1.;\n }\n if(a.z == b.z) {\n result.z = 1.;\n }\n if(a.w == b.w) {\n result.w = 1.;\n }
}\n\nreturn result;\n`;\n\nexport const realDiv
= binaryKernelFunc(\n {opSnippet: DIV, packedOpSnippet: DIV_PACKED, checkOutOfBounds:
true});\n\nexport const realDivConfig: KernelConfig = {\n kernelName: RealDiv,\n backendName: 'webgl',\n
kernelFunc: realDiv,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc,
Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{MathBackendWebGL} from './backend_webgl';\nimport {exp} from './Exp';\nimport {max} from
 './Max';\nimport {realDiv} from './RealDiv';\nimport {reshape} from './Reshape';\nimport {sub} from
 './Sub';\nimport {sum} from './Sum';\n\nexport function softmax(args: {\n inputs: SoftmaxInputs,\n backend:
MathBackendWebGL,\n attrs: SoftmaxAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{logits} = inputs;\n const {dim} = attrs;\n\n const axes = util.parseAxisParam([dim], logits.shape);\n\n const
maxLogit = max({\n inputs: {x: logits},\n backend,\n attrs: {reductionIndices: axes, keepDims: false}\n
});\n\n const expandedShape = backend_util.expandShapeToKeepDim(maxLogit.shape, axes);\n\n const
maxLogitsReshaped =\n reshape({inputs: {x: maxLogit}, backend, attrs: {shape: expandedShape}});\n const a
=\n sub({inputs: {a: logits, b: maxLogitsReshaped},
backend}) as TensorInfo;\n const b = exp({inputs: {x: a}, backend}) as TensorInfo;\n const sumExp =\n
sum({inputs: {x: b}, backend, attrs: {axis: axes, keepDims: false}});\n const sumExpReshaped =\n
reshape({inputs: {x: sumExp}, backend, attrs: {shape: expandedShape}});\n\n const res =\n realDiv({inputs: {a:
b, b: sumExpReshaped}, backend}) as TensorInfo;\n\n backend.disposeIntermediateTensorInfo(maxLogit);\n

```

```

backend.disposeIntermediateTensorInfo(maxLogitsReshaped);\n backend.disposeIntermediateTensorInfo(a);\n
backend.disposeIntermediateTensorInfo(b);\n backend.disposeIntermediateTensorInfo(sumExp);\n
backend.disposeIntermediateTensorInfo(sumExpReshaped);\n\n return res;\n}\n\nexport const softmaxConfig:
KernelConfig = {\n kernelName: Softmax,\n backendName: 'webgl',\n kernelFunc: softmax as {} as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { KernelConfig, KernelFunc, Multinomial, MultinomialAttrs, MultinomialInputs, TensorInfo } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport
{ MultinomialProgram } from './multinomial_gpu';\n\nimport { softmax } from './Softmax';\n\nexport function
multinomial(args: {\n inputs: MultinomialInputs,\n backend: MathBackendWebGL,\n attrs: MultinomialAttrs\n}):
TensorInfo
{\n const { inputs, backend, attrs } = args;\n const { logits } = inputs;\n const { numSamples, seed, normalized } =
attrs;\n\n const probs = normalized ?\n logits :\n softmax(\n {inputs: {logits}, backend, attrs: {dim:
logits.shape.length - 1}});\n const batchSize = probs.shape[0];\n const numOutcomes = probs.shape[1];\n const
program = new MultinomialProgram(batchSize, numOutcomes, numSamples);\n const customSetup =
program.getCustomSetupFunc(seed);\n\n const res = backend.runWebGLProgram(program, [probs], 'int32',
customSetup);\n if (!normalized) {\n backend.disposeIntermediateTensorInfo(probs);\n }\n return
res;\n}\n\nexport const multinomialConfig: KernelConfig = {\n kernelName: Multinomial,\n backendName:
'webgl',\n kernelFunc: multinomial as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV3,
NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TypedArray } from '@tensorflow/tfjs-core';\n\nconst
nonMaxSuppressionV3Impl = kernel_impls.nonMaxSuppressionV3Impl;\n\nimport { MathBackendWebGL } from
'../backend_webgl';\n\nexport function nonMaxSuppressionV3(args: {\n inputs: NonMaxSuppressionV3Inputs,\n
backend: MathBackendWebGL,\n attrs: NonMaxSuppressionV3Attrs\n})
{\n backend_util.warn(\n 'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call
tf.nonMaxSuppressionAsync() instead');\n\n const { inputs, backend, attrs } = args;\n const { boxes, scores } =
inputs;\n const { maxOutputSize, iouThreshold, scoreThreshold } = attrs;\n\n const boxesVals =
backend.readSync(boxes.dataId) as TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as
TypedArray;\n\n const { selectedIndices } = nonMaxSuppressionV3Impl(\n boxesVals, scoresVals,
maxOutputSize, iouThreshold, scoreThreshold);\n\n return backend.makeTensorInfo(\n [selectedIndices.length],
'int32', new Int32Array(selectedIndices));\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n
kernelName: NonMaxSuppressionV3,\n backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV3 as {} as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```

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```
=====\n*\n\nimport { backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV4,
NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo, TypedArray } from '@tensorflow/tfjs-
core';\nconst nonMaxSuppressionV4Impl = kernel_impls.nonMaxSuppressionV4Impl;\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nexport function nonMaxSuppressionV4(args: {\n inputs:
NonMaxSuppressionV4Inputs,\n backend: MathBackendWebGL,\n
attrs: NonMaxSuppressionV4Attrs\n}): [TensorInfo, TensorInfo] {\n backend_util.warn(\n
'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call tf.nonMaxSuppressionAsync() instead');\n\n
const {inputs, backend, attrs} = args;\n const {boxes, scores} = inputs;\n const {maxOutputSize, iouThreshold,
scoreThreshold, padToMaxOutputSize} =\n attrs;\n\n const boxesVals = backend.readSync(boxes.dataId) as
TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as TypedArray;\n\n const {selectedIndices,
validOutputs} = nonMaxSuppressionV4Impl(\n boxesVals, scoresVals, maxOutputSize, iouThreshold,
scoreThreshold,\n padToMaxOutputSize);\n\n return [\n backend.makeTensorInfo(\n
[selectedIndices.length], 'int32', new Int32Array(selectedIndices)),\n backend.makeTensorInfo([], 'int32', new
Int32Array([validOutputs]))\n];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n
kernelName: NonMaxSuppressionV4,\n
backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV5,
NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo, TypedArray } from '@tensorflow/tfjs-
core';\n\nconst
nonMaxSuppressionV5Impl = kernel_impls.nonMaxSuppressionV5Impl;\n\nimport {MathBackendWebGL} from
 '../backend_webgl';\n\nexport function nonMaxSuppressionV5(args: {\n inputs: NonMaxSuppressionV5Inputs,\n
backend: MathBackendWebGL,\n attrs: NonMaxSuppressionV5Attrs\n}): [TensorInfo, TensorInfo] {\n
backend_util.warn(\n 'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call
tf.nonMaxSuppressionAsync() instead');\n\n const {inputs, backend, attrs} = args;\n const {boxes, scores} =
inputs;\n const {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma} = attrs;\n\n const boxesVals =
backend.readSync(boxes.dataId) as TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as
TypedArray;\n\n const maxOutputSizeVal = maxOutputSize;\n const iouThresholdVal = iouThreshold;\n const
scoreThresholdVal = scoreThreshold;\n const softNmsSigmaVal = softNmsSigma;\n\n const {selectedIndices,
selectedScores} = nonMaxSuppressionV5Impl(\n boxesVals,
scoresVals, maxOutputSizeVal, iouThresholdVal,\n scoreThresholdVal, softNmsSigmaVal);\n\n return [\n
backend.makeTensorInfo(\n [selectedIndices.length], 'int32', new Int32Array(selectedIndices)),\n
backend.makeTensorInfo(\n [selectedScores.length], 'float32', new Float32Array(selectedScores))\n
];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n
backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV5 as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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```

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OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class OneHotProgram implements GPGPUProgram {\n variableNames = ['indices'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for speed.\n seedLoc: WebGLUniformLocation;\n\n constructor(\n numIndices: number, depth: number, onValue: number, offValue: number) {\n this.outputShape = [numIndices, depth];\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n int index = round(getIndices(coords.x));\n setOutput(mix(float(${offValue}), float(${onValue}),\n float(index == coords.y));\n }\n `;\n}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {OneHotProgram} from './onehot_gpu';\nimport {reshape} from './Reshape';\n\nexport const oneHot = (args: {\n inputs: OneHotInputs,\n backend: MathBackendWebGL,\n attrs: OneHotAttrs\n}): TensorInfo => {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const indicesSize = util.sizeFromShape(indices.shape);\n const program = new OneHotProgram(indicesSize, depth, onValue, offValue);\n const reshaped =\n reshape({inputs: {x: indices}, backend, attrs: {shape: [indicesSize]}});\n const result = backend.runWebGLProgram(program, [reshaped], indices.dtype);\n backend.disposeIntermediateTensorInfo(reshaped);\n\n const outShape = [...indices.shape, depth];\n const out = reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});\n backend.disposeIntermediateTensorInfo(result);\n return out;\n};\n\nexport const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'webgl',\n kernelFunc: oneHot as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n
```

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {complex} from './Complex';\nimport {fill} from './Fill';\nimport {imag} from './Imag';\nimport {real} from './Real';\n\nexport function zerosLike(\n args: {\n inputs: ZerosLikeInputs,\n backend: MathBackendWebGL\n }): TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n if (x.dtype === 'complex64') {\n const realPart = real({inputs: {input: x}, backend});\n const r = zerosLike({inputs: {x: realPart}, backend});\n const imagPart = imag({inputs: {input: x}, backend});\n const i = zerosLike({inputs: {x: imagPart}, backend});\n\n const result = complex({inputs:
```



```

{real: r, imag: i}, backend));\n\n backend.disposeIntermediateTensorInfo(realPart);\nbackend.disposeIntermediateTensorInfo(r);\n backend.disposeIntermediateTensorInfo(imagPart);\nbackend.disposeIntermediateTensorInfo(i);\n\n return result;\n } else {\n return fill({\n attrs: {\n shape:\n x.shape,\n dtype: x.dtype,\n value: x.dtype === 'string' ? " : 0\n },\n backend\n });\n }\n}\n\nexport\nconst zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'webgl',\n kernelFunc:\n zerosLike as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\n http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs, TensorInfo} from '@tensorflow/tfjs-\ncore';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {complex} from './Complex';\nimport {fill} from './Fill';\nimport {imag} from './Imag';\nimport {real} from './Real';\nimport {zerosLike} from './ZerosLike';\n\nexport\nfunction onesLike(\n args: {inputs: OnesLikeInputs, backend: MathBackendWebGL}): TensorInfo {\n const\n {inputs, backend} = args;\n const {x} = inputs;\n\n if (x.dtype === 'string') {\n throw new Error('onesLike is not\n supported under string dtype');\n } else if (x.dtype === 'complex64') {\n const realPart = real({inputs: {input: x},\n backend});\n const r = onesLike({inputs: {x: realPart}, backend});\n const imagPart = imag({inputs: {input: x},\n backend});\n const i = zerosLike({inputs: {x: imagPart}, backend});\n\n const result = complex({inputs: {real: r,\n imag: i}, backend});\n\n backend.disposeIntermediateTensorInfo(realPart);\n\n backend.disposeIntermediateTensorInfo(r);\n backend.disposeIntermediateTensorInfo(imagPart);\n\n backend.disposeIntermediateTensorInfo(i);\n\n return result;\n } else {\n // TODO(cais, smilkov): Add WebGL\n shader for onesLike.\n // https://github.com/tensorflow/tfjs/issues/1293\n return fill({attrs: {shape:\n x.shape, dtype: x.dtype, value: 1}, backend});\n }\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'webgl',\n kernelFunc: onesLike as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {concat}\n from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs:\n PackInputs, backend: MathBackendWebGL, attrs: PackAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} =\n args;\n const {axis} = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {\n inputs: {input:\n inputs[0]},\n backend,\n attrs: {dim: axis}\n });\n }\n\n const shape = inputs[0].shape;\n const dtype =\n inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors\n passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed\n to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const\n expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t},\n backend,\n attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(\n t => backend.disposeIntermediateTensorInfo(t));\n\n return result;\n}\n\nexport const packConfig: KernelConfig =

```

{\n kernelName: Pack,\n backendName: 'webgl',\n kernelFunc: pack as { } as KernelFunc\n};\n"/\*\*\n \* @license\n \* Copyright 2017 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific

language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class PadProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[],\n paddings: Array<[number, number]>,\n constantValue: number) {\n this.outputShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n const rank = xShape.length;\n const type = getCoordsDataType(rank);\n const start = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');\n const unpackedCoords =\n ['coords[0]', 'coords[1]', 'coords[2]', 'coords[3]'].slice(0, rank);\n if (rank === 1) {\n this.userCode = `\n int start = ${start};\n int end = ${end};\n void main() {\n int outC = getOutputCoords();\n if (outC < start || outC >= end) {\n setOutput(float(${constantValue}));\n } else {\n setOutput(getX(outC - start));\n }\n }\n `;\n return;\n }\n this.userCode = `\n ${type} start = ${type}(${start});\n ${type} end = ${type}(${end});\n void main() {\n ${type} outC = getOutputCoords();\n if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {\n setOutput(float(${constantValue}));\n } else {\n ${type} coords = outC - start;\n setOutput(getX(${unpackedCoords}));\n }\n }\n `;\n }\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License
```

at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class PadPackedProgram implements GPGPUProgram {\n variableNames = ['x'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[],\n paddings: Array<[number, number]>,\n constantValue: number) {\n this.outputShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n const rank = xShape.length;\n const dtype = getCoordsDataType(rank);\n const start = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');\n const coords = getChannels('rc', rank);\n const source = getChannels('source', rank);\n const cLimit = `${coords[rank - 1]} < ${this.outputShape[rank - 1]}`;\n const innerDims =\n rank === 1 ? 'source' : `vec2(${source.slice(-2).join()})`;\n const componentSetup = [\n `${dtype} rc = outputLoc;`,\n `${coords[rank - 1]} += 1;`\n];\n if (cLimit) {\n `;\n rank === 1 ? " : "`;\n rc = outputLoc;\n ${coords[rank - 2]} += 1;`\n];\n if (coords[rank - 2] < this.outputShape[rank - 2]) {\n `;\n rank === 1 ? " : "`;\n ${coords[rank - 1]} += 1;`\n];\n if (cLimit) {\n `;\n `;\n];\n const paddingArea = rank === 1 ?\n 'rc < start || rc >= end' :\n 'any(lessThan(rc, start)) || any(greaterThanEqual(rc, end))';\n\n let mainLoop = ";\n for (let i = 0, j = rank === 1 ? 2 : 4; i < j; i++) {\n mainLoop += `\n ${componentSetup[i]}\n if (${paddingArea}) {\n result[${i}] = float(${constantValue});\n } else {\n ${dtype} source = rc - start;\n result[${i}] = getChannel(getX(${source.join()}), ${innerDims});\n }\n `;\n }\n}\n"/
```

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};\n } \n mainLoop += (rank === 1 ? ` ` : ` `);\n\n this.userCode = \n const ${dtype} start =
${dtype}(${start});\n const ${dtype} end = ${dtype}(${end});\n\n void main() {\n ${dtype} outputLoc =
getOutputCoords();\n vec4 result = vec4(0.); \n ${mainLoop}\n setOutput(result);\n }\n `;\n
}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
===== \n
*/\n\nimport {env, KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, TensorInfo} from
'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {PadProgram} from
'./pad_gpu';\nimport {PadPackedProgram} from './pad_packed_gpu';\n\nexport const padV2 = (\n args: {inputs:
PadV2Inputs, backend: MathBackendWebGL, attrs: PadV2Attrs}): \n TensorInfo => {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const {paddings, constantValue} = attrs;\n\n const
program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ? \n new
PadPackedProgram(x.shape, paddings, constantValue) : \n new PadProgram(x.shape, paddings,
constantValue);\n\n return backend.runWebGLProgram(program, [x], x.dtype);\n }; \n\nexport const
padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'webgl',\n kernelFunc: padV2 as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
===== \n
*/\n\nimport {KernelConfig, KernelFunc, Pow} from '@tensorflow/tfjs-core';\nimport
{CHECK_NAN_SNIPPET} from './binaryop_packed_gpu';\nimport {binaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst POW = \n if(a < 0.0 && floor(b) < b) \n return NAN;\n } \n if (b
=== 0.0) \n return 1.0;\n } \n return (round(mod(b, 2.0)) !== 1) ? \n pow(abs(a), b) : sign(a) * pow(abs(a),
b);\n `;\n\nconst POW_PACKED = \n // isModRound1 has 1 for components with round(mod(b, 2.0)) === 1, 0
otherwise.\n vec4 isModRound1 = vec4(equal(round(mod(b, 2.0)), ivec4(1)));\n vec4 multiplier = sign(a) *
isModRound1 + (vec4(1.0) - isModRound1);\n vec4 result = multiplier * pow(abs(a), b);\n // Ensure that a^0 = 1,
including 0^0 = 1 as this correspond to TF and JS\n bvec4 isExpZero = equal(b, vec4(0.0));\n result.r =
isExpZero.r ? 1.0 : result.r;\n\n result.g = isExpZero.g ? 1.0 : result.g;\n result.b = isExpZero.b ? 1.0 : result.b;\n result.a = isExpZero.a ? 1.0 :
result.a;\n\n vec4 isNaN = vec4(lessThan(a, vec4(0.0))) * vec4(lessThan(floor(b), b));\n ` + \n
CHECK_NAN_SNIPPET + \n\n return result;\n `;\n\nexport const pow = \n binaryKernelFunc({opSnippet: POW,
packedOpSnippet: POW_PACKED});\n\nexport const powConfig: KernelConfig = {\n kernelName: Pow,\n
backendName: 'webgl',\n kernelFunc: pow as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either

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express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const range =\n (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {\n const {backend, attrs} = args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n return backend.makeTensorInfo([values.length], dtype, values);\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'webgl',\n kernelFunc: range as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst RECIPROCAL = `return 1.0 / x;`\n\nexport const reciprocal = unaryKernelFunc({opSnippet: RECIPROCAL});\n\nexport const reciprocalConfig: KernelConfig = {\n kernelName: Reciprocal,\n backendName: 'webgl',\n kernelFunc: reciprocal,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Relu} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst RELU = CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : x;\n`\n\nconst RELU_PACKED = `\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n\n result.r = isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a : result.a;\n\n return result;\n`\n\nexport const relu =\n unaryKernelFunc({opSnippet: RELU, packedOpSnippet: RELU_PACKED});\n\nexport const reluConfig: KernelConfig = {\n kernelName: Relu,\n backendName: 'webgl',\n kernelFunc: relu as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Relu6} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst RELU6 = CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : min(6.0, x);\n`\n\nconst RELU6_PACKED = `\n vec4 result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n\n result.r = isNaN.r`
```

```
? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a :
result.a;\n\n return result;\n`;\n\nexport const relu6 =\n unaryKernelFunc({opSnippet: RELU6, packedOpSnippet:
RELU6_PACKED});\n\nexport const relu6Config: KernelConfig = {\n kernelName: Relu6,\n backendName:
'webgl',\n kernelFunc: relu6 as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeBilinearProgram implements
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n
inputShape: [number, number, number, number], newHeight: number,\n newWidth: number, alignCorners:
boolean, halfPixelCenters: boolean) {\n const [batch, oldHeight, oldWidth, depth] = inputShape;\n
this.outputShape = [batch, newHeight, newWidth, depth];\n\n const effectiveInSize: [number, number] = [\n
(alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n (alignCorners && newWidth > 1) ? oldWidth -
1 : oldWidth\n];\n\n const effectiveOutSize: [number, number] = [\n (alignCorners && newHeight > 1) ?
newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n];\n\n let
sourceFracIndexRC: string;\n if (halfPixelCenters) {\n sourceFracIndexRC =\n `(\n vec2(yRC) + vec2(0.5))
* effectiveInputOverOutputRatioRC` +\n ` - vec2(0.5)`;\n } else {\n sourceFracIndexRC = `vec2(yRC) *
effectiveInputOverOutputRatioRC`;\n }\n\n this.userCode = `\n const vec2
effectiveInputOverOutputRatioRC
= vec2(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n
const vec2 inputShapeRC = vec2(${oldHeight}.0, ${oldWidth}.0);\n\n void main() {\n ivec4 coords =
getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n ivec2 yRC = coords.yz;\n\n //
Fractional source index.\n vec2 sourceFracIndexRC = ${sourceFracIndexRC};\n\n // Compute the four
integer indices.\n ivec2 sourceFloorRC = ivec2(max(sourceFracIndexRC, vec2(0.0)));\n ivec2
sourceCeilRC = ivec2(\n min(inputShapeRC - 1.0, ceil(sourceFracIndexRC)));\n\n float topLeft = getA(b,
sourceFloorRC.x, sourceFloorRC.y, d);\n float bottomLeft = getA(b, sourceCeilRC.x, sourceFloorRC.y, d);\n
float topRight = getA(b, sourceFloorRC.x, sourceCeilRC.y, d);\n float bottomRight = getA(b, sourceCeilRC.x,
sourceCeilRC.y, d);\n\n vec2 fracRC = sourceFracIndexRC
- vec2(sourceFloorRC);\n\n float top = topLeft + (topRight - topLeft) * fracRC.y;\n float bottom =
bottomLeft + (bottomRight - bottomLeft) * fracRC.y;\n\n float newValue = top + (bottom - top) * fracRC.x;\n\n
setOutput(newValue);\n }\n `;\n }\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

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=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeBilinearPackedProgram implements
GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape:
number[] = [];\n userCode: string;\n\n constructor(\n inputShape: [number, number, number, number],
newHeight: number,\n newWidth: number, alignCorners: boolean, halfPixelCenters: boolean) {\n const [batch,
oldHeight, oldWidth, depth] = inputShape;\n this.outputShape = [batch, newHeight, newWidth, depth];\n\n const
effectiveInSize: [number, number] = [\n (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n
```

```

 (alignCorners && newWidth > 1) ? oldWidth - 1 : oldWidth\n];\n\n const effectiveOutSize: [number, number]
= [\n (alignCorners && newHeight > 1) ? newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ?
newWidth - 1 : newWidth\n];\n\n let sourceFracIndexRC: string;\n if (halfPixelCenters) {\n
 sourceFracIndexRC = `(vec3(yRC) + vec3(0.5)) * ` +\n `effectiveInputOverOutputRatioRC - vec3(0.5)`;\n
 } else {\n sourceFracIndexRC = `vec3(yRC) * effectiveInputOverOutputRatioRC`;\n }\n\n this.userCode =
`\n const vec3 effectiveInputOverOutputRatioRC = vec3(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n
 ${effectiveInSize[1] / effectiveOutSize[1]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n const vec3
inputShapeRC = vec3(${oldHeight}.0, ${oldWidth}.0,\n ${oldWidth}.0);\n\n float
getAValue(int b, int r, int c, int d) {\n return getChannel(getA(b, r, c, d), vec2(c, d));\n }\n\n void main()
{\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n // Calculate
values for next column in yRC.z.\n ivec3 yRC = coords.yzz + ivec3(0, 0, 1);\n // Fractional source
index.\n vec3 sourceFracIndexRC
= ${sourceFracIndexRC};\n\n // Compute the four integer indices.\n ivec3 sourceFloorRC =
ivec3(max(sourceFracIndexRC, vec3(0.0)));\n ivec3 sourceCeilRC = ivec3(\n min(inputShapeRC - 1.0,
ceil(sourceFracIndexRC));\n\n // Should we calculate next column and row elements in 2x2 packed cell.\n
bool hasNextCol = d < ${depth - 1};\n bool hasNextRow = coords.z < ${newWidth - 1};\n\n // In parallel,
construct four corners for all four components in\n // packed 2x2 cell.\n vec4 topLeft = vec4(\n
getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),\n hasNextCol ? getAValue(b, sourceFloorRC.x,
sourceFloorRC.y, d + 1)\n : 0.0,\n hasNextRow ? getAValue(b, sourceFloorRC.x,
sourceFloorRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b,
sourceFloorRC.x, sourceFloorRC.z, d + 1) : 0.0);\n\n vec4 bottomLeft = vec4(\n getAValue(b,
sourceCeilRC.x, sourceFloorRC.y, d),\n hasNextCol ? getAValue(b, sourceCeilRC.x, sourceFloorRC.y, d +
1)\n : 0.0,\n hasNextRow ? getAValue(b, sourceCeilRC.x, sourceFloorRC.z, d)\n :
0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceCeilRC.x, sourceFloorRC.z, d + 1) :
0.0);\n\n vec4 topRight = vec4(\n getAValue(b, sourceFloorRC.x, sourceCeilRC.y, d),\n hasNextCol
? getAValue(b, sourceFloorRC.x, sourceCeilRC.y, d + 1)\n : 0.0,\n hasNextRow ? getAValue(b,
sourceFloorRC.x, sourceCeilRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n
getAValue(b, sourceFloorRC.x, sourceCeilRC.z, d + 1) : 0.0);\n\n vec4 bottomRight = vec4(\n
getAValue(b, sourceCeilRC.x, sourceCeilRC.y, d),\n hasNextCol ? getAValue(b, sourceCeilRC.x,
sourceCeilRC.y, d + 1)\n : 0.0,\n hasNextRow ? getAValue(b, sourceCeilRC.x, sourceCeilRC.z, d)\n
 : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceCeilRC.x, sourceCeilRC.z, d + 1) : 0.0);\n\n
 vec3 fracRC = sourceFracIndexRC -
vec3(sourceFloorRC);\n\n vec4 top = mix(topLeft, topRight, fracRC.yzz);\n vec4 bottom =
mix(bottomLeft, bottomRight, fracRC.yzz);\n vec4 newValue = mix(top, bottom, fracRC.x);\n\n setOutput(newValue);\n }\n `;\n}\n}\n}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\n
*/\n\nimport {env, KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{ResizeBilinearProgram} from '../resize_bilinear_gpu';\nimport {ResizeBilinearPackedProgram} from
'../resize_bilinear_packed_gpu';\n\nexport function resizeBilinear(args: {\n inputs: ResizeBilinearInputs,\n
backend: MathBackendWebGL,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =

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args;\n const { images } = inputs;\n const { alignCorners, halfPixelCenters, size } = attrs;\n\n const [newHeight,
newWidth] = size;\n\n const program = env().getBool('WEBGL_PACK_IMAGE_OPERATIONS') ?\n new
ResizeBilinearPackedProgram(\n
 images.shape as [number, number, number, number], newHeight, newWidth,\n
 alignCorners,
halfPixelCenters) :\n new ResizeBilinearProgram(\n
 images.shape as [number, number, number, number],
newHeight, newWidth,\n
 alignCorners, halfPixelCenters);\n return backend.runWebGLProgram(program,
[images], 'float32');\n\n\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n
backendName: 'webgl',\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n */
=====\n
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeBilinearBackpropProgram implements
GPGPUProgram {\n variableNames = ['dy'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n
 dyShape: [number, number, number, number],\n inputShape: [number, number, number, number],
alignCorners: boolean) {\n this.outputShape = inputShape;\n const [, xHeight, xWidth,] = inputShape;\n const
[, yHeight, yWidth] = dyShape;\n\n // In the backwards pass, we want to find the pixels that were generated for\n
// each pixel in the input image the forward pass and add the corresponding\n // coefficient from dy to the gradient
(with some interpolation).\n\n const effectiveXSize: [number, number] = [\n (alignCorners
&& yHeight > 1) ? xHeight - 1 : xHeight,\n (alignCorners && yWidth > 1) ? xWidth - 1 : xWidth\n];\n\n const effectiveYSize: [number, number] = [\n (alignCorners && yHeight > 1) ? yHeight - 1 : yHeight,\n
(alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n];\n\n const heightScale = effectiveXSize[0] /
effectiveYSize[0];\n const widthScale = effectiveXSize[1] / effectiveYSize[1];\n\n const invHeightScale = 1 /
heightScale;\n const invWidthScale = 1 / widthScale;\n\n // This defines the size of the window of values around
a particular\n // index in dy that we want to search for contributions to dx.\n const winHeight =
(Math.ceil(invHeightScale) * 2) + 2;\n const winWidth = (Math.ceil(invWidthScale) * 2) + 2;\n\n this.userCode
= `\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n
 int r = coords[1];\n int c = coords[2];\n\n float accumulator
= 0.0;\n\n const float heightScale = float(${heightScale});\n const float widthScale =
float(${widthScale});\n\n const float invHeightScale = float(${invHeightScale});\n const float
invWidthScale = float(${invWidthScale});\n\n const int winHeight = int(${winHeight});\n const int
winWidth = int(${winWidth});\n\n // Compute bounds for where in dy we will look\n float startRLerp =
floor(float(r) * invHeightScale);\n int startDyR = int(startRLerp - float(winHeight / 2));\n\n float startCLerp
= floor(float(c) * invWidthScale);\n int startDyC = int(startCLerp - float(winWidth / 2));\n\n // Loop over
dy\n for (int dyROffset = 0; dyROffset < winHeight; dyROffset++) {\n int dyR = dyROffset +
startDyR;\n\n // Guard against the window exceeding the bounds of dy\n if (dyR < 0 || dyR >=
${yHeight}) {\n continue;\n }\n\n for (int dyCOffset = 0; dyCOffset
< winWidth; dyCOffset++) {\n int dyC = dyCOffset + startDyC;\n\n // Guard against the window
exceeding the bounds of dy\n if (dyC < 0 || dyC >= ${yWidth}) {\n continue;\n }\n\n
float dxR = float(dyR) * heightScale;\n int topDxRIndex = int(floor(dxR));\n int bottomDxRIndex =
int(min(ceil(dxR), ${xHeight} - 1).0);\n float dxRLerp = dxR - float(topDxRIndex);\n float
inverseDxRLerp = 1.0 - dxRLerp;\n\n float dxC = float(dyC) * widthScale;\n int leftDxCIndex =
int(floor(dxC));\n int rightDxCIndex = int(min(ceil(dxC), ${xWidth} - 1).0);\n float dxCLerp = dxC -
float(leftDxCIndex);\n float inverseDxClerp = 1.0 - dxCLerp;\n\n if (r == topDxRIndex && c ==

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leftDxCIndex) {\n // topLeft\n accumulator +=\n getDy(b, dyR, dyC, d) * inverseDxRLerp
* inverseDxClerp;\n
}\n\n if (r == topDxRIndex && c == rightDxCIndex) {\n // topRight\n accumulator +=
getDy(b, dyR, dyC, d) * inverseDxRLerp * dxClerp;\n }\n\n if (r == bottomDxRIndex && c ==
leftDxCIndex) {\n // bottomLeft\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp *
inverseDxClerp;\n }\n\n if (r == bottomDxRIndex && c == rightDxCIndex) {\n //
bottomRight\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp * dxClerp;\n }\n }\n
\n // End loop over dy\n setOutput(accumulator);\n }\n `;\n }\n }\n }", "/*\n * @license\n * Copyright
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applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {KernelConfig, KernelFunc, ResizeBilinearGrad, ResizeBilinearGradAttrs, ResizeBilinearGradInputs,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{ResizeBilinearBackpropProgram} from '../resize_bilinear_backprop_gpu';\n\n\nexport function
resizeBilinearGrad(args: {\n inputs: ResizeBilinearGradInputs,\n backend: MathBackendWebGL,\n attrs:
ResizeBilinearGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {images, dy} = inputs;\n
const {alignCorners} = attrs;\n\n const program = new ResizeBilinearBackpropProgram(\n
dy.shape as [number, number, number, number],\n images.shape as [number, number, number, number],
alignCorners);\n\n return backend.runWebGLProgram(program, [dy, dy.dtype]);\n\n}\n\n\nexport const
resizeBilinearGradConfig: KernelConfig = {\n kernelName: ResizeBilinearGrad,\n backendName: 'webgl',\n
kernelFunc: resizeBilinearGrad as {} as KernelFunc\n};\n}", "/*\n * @license\n * Copyright 2018 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n\nimport {GPGPUProgram} from '../gpgpu_math';\n\n\nexport class ResizeNearestNeighborProgram implements
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n
inputShape: [number, number, number, number], newHeight: number,\n newWidth: number, alignCorners:
boolean, halfPixelCenters: boolean) {\n const [batch, oldHeight, oldWidth, depth] = inputShape;\n
this.outputShape = [batch, newHeight, newWidth, depth];\n\n const effectiveInSize: [number, number] = [\n
(alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n (alignCorners && newWidth > 1) ? oldWidth -
1 : oldWidth\n];\n\n const effectiveOutSize: [number, number] = [\n
(alignCorners && newHeight > 1) ?\n newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ?\n newWidth - 1 : newWidth\n];\n\n // When
align corners is false,
we rounds the value with floor.\n const roundBase = alignCorners ? '0.5' : '0.0';\n\n let sourceFracIndexRC:
string;\n if (halfPixelCenters) {\n sourceFracIndexRC =\n `max((vec2(yRC) + vec2(0.5)) *
effectiveInputOverOutputRatioRC` +\n `, vec2(0.0))`;}\n } else {\n sourceFracIndexRC = `vec2(yRC) *
effectiveInputOverOutputRatioRC`;\n }\n this.userCode = `\n const vec2 effectiveInputOverOutputRatioRC
= vec2(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n
const vec2 inputShapeRC = vec2(${oldHeight}.0, ${oldWidth}.0);\n\n void main() {\n ivec4 coords =

```



```

getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n ivec2 yRC = coords.yz;\n\n //
Fractional source index.\n vec2 sourceFracIndexRC = ${sourceFracIndexRC};\n // Compute the
coordinators of nearest neighbor point.\n ivec2 sourceNearestRC = ivec2(\n
 min(inputShapeRC - 1.0, floor(sourceFracIndexRC + ${roundBase}));\n float newValue = getA(b,
sourceNearestRC.x, sourceNearestRC.y, d);\n\n setOutput(newValue);\n } \n `;\n }\n\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport { KernelConfig, KernelFunc, ResizeNearestNeighbor, ResizeNearestNeighborAttrs,
ResizeNearestNeighborInputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { ResizeNearestNeighborProgram } from './resize_nearest_neighbor_gpu';\n\nexport
function resizeNearestNeighbor(args: {\n inputs: ResizeNearestNeighborInputs,\n backend:
MathBackendWebGL,\n attrs: ResizeNearestNeighborAttrs\n}): TensorInfo {\n const { inputs, backend, attrs } =
args;\n const { images } = inputs;\n const { alignCorners, halfPixelCenters, size } = attrs;\n\n const [newHeight,
newWidth] = size;\n\n const program = new ResizeNearestNeighborProgram(\n images.shape as [number,
number, number, number], newHeight, newWidth,\n alignCorners, halfPixelCenters);\n return
backend.runWebGLProgram(program, [images], images.dtype);\n}\n\nexport const resizeNearestNeighborConfig:
KernelConfig = {\n kernelName: ResizeNearestNeighbor,\n backendName: 'webgl',\n kernelFunc:
resizeNearestNeighbor as { } as KernelFunc\n};\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeNearestNeighborBackpropProgram
implements GPGPUProgram {\n variableNames = ['dy'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n dyShape: [number, number, number, number],\n
 inputShape: [number, number, number, number], alignCorners: boolean) {\n this.outputShape = inputShape;\n
 const [, xHeight, xWidth,] = inputShape;\n const [, yHeight, yWidth] = dyShape;\n\n // In the backwards pass,
we want to find the pixels that were generated for\n // each pixel in the input image the forward pass and add the
corresponding\n // coefficient from dy to the gradient (with some interpolation).\n\n const effectiveXSize:
[number, number] = [\n (alignCorners && yHeight > 1) ? xHeight - 1 : xHeight,\n (alignCorners && yWidth
> 1) ? xWidth - 1 : xWidth\n];\n\n const effectiveYSize: [number, number] = [\n (alignCorners && yHeight
> 1) ? yHeight - 1 : yHeight,\n (alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n];\n\n const
heightScale = effectiveXSize[0] / effectiveYSize[0];\n const widthScale = effectiveXSize[1] /
effectiveYSize[1];\n\n const invHeightScale = 1 / heightScale;\n const invWidthScale = 1 /
widthScale;\n\n // This defines the size of the window of values around a particular\n // index in dy that we want
to search for contributions to dx.\n const windowHeight = (Math.ceil(invHeightScale) * 2) + 2;\n const winWidth =
(Math.ceil(invWidthScale) * 2) + 2;\n\n this.userCode = `\n void main() {\n ivec4 coords =
getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n int r = coords[1];\n int c =
coords[2];\n\n float accumulator = 0.0;\n const float heightScale = float(${heightScale});\n const
float widthScale = float(${widthScale});\n const float invHeightScale = float(${invHeightScale});\n const

```

```

float invWidthScale = float({invWidthScale});\n\n const int winHeight = int({winHeight});\n const int
winWidth = int({winWidth});\n\n // Compute bounds for where in dy we will look\n float startRLerp =
floor(float(r) * invHeightScale);\n int startDyR =
int(floor(startRLerp - float(winHeight / 2)));
float startCLerp = floor(float(c) * invWidthScale);\n int
startDyC = int(floor(startCLerp - float(winWidth / 2)));
// Loop over dy\n for (int dyROffset = 0;
dyROffset < winHeight; dyROffset++) {\n int dyR = dyROffset + startDyR;\n\n // Guard against the
window exceeding the bounds of dy\n if (dyR < 0 || dyR >= {yHeight}) {\n continue;\n }\n\n for (int dyCOffset = 0; dyCOffset < winWidth; dyCOffset++) {\n int dyC = dyCOffset + startDyC;\n\n // Guard against the window exceeding the bounds of dy\n if (dyC < 0 || dyC >= {yWidth}) {\n continue;\n }\n\n float sourceFracRow =\n float({effectiveXSize[0]}) * \n (float(dyR) / float({effectiveYSize[0]}));\n\n float sourceFracCol =\n float({effectiveXSize[1]}) * \n (float(dyC) / float({effectiveYSize[1]}));\n\n int sourceNearestRow = int(min(\n float(int({xHeight}) - 1),\n {alignCorners} ? float(round(sourceFracRow)) : \n float(floor(sourceFracRow)));\n\n int sourceNearestCol = int(min(\n float(int({xWidth}) - 1),\n {alignCorners} ? \n float(round(sourceFracCol)) : \n float(floor(sourceFracCol)));\n\n if (r ==
sourceNearestRow && c == sourceNearestCol) {\n accumulator += getDy(b, dyR, dyC, d);\n }\n }\n }\n // End loop over dy\n setOutput(accumulator);\n}\n`;\n}\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*/\n\nimport { KernelConfig, KernelFunc, ResizeNearestNeighborGrad, ResizeNearestNeighborGradAttrs,
ResizeNearestNeighborGradInputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL }
from './backend_webgl';\n\nimport { ResizeNearestNeighborBackpropProgram } from
'./resize_nearest_neighbor_backprop_gpu';\n\nexport function resizeNearestNeighborGrad(args: {\n inputs:
ResizeNearestNeighborGradInputs,\n backend: MathBackendWebGL,\n attrs:
ResizeNearestNeighborGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {images, dy} = inputs;\n const {alignCorners} = attrs;\n\n const program = new
ResizeNearestNeighborBackpropProgram(\n dy.shape as [number, number, number, number],\n images.shape
as [number, number, number, number], alignCorners);\n return backend.runWebGLProgram(program, [dy],
dy.dtype);\n}\n\nexport const resizeNearestNeighborGradConfig: KernelConfig = {\n kernelName:
ResizeNearestNeighborGrad,\n backendName: 'webgl',\n kernelFunc: resizeNearestNeighborGrad as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nimport { getCoordsDataType } from
'./shader_compiler';\n\nexport class ReverseProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(xShape: number[], axis: number[]) {\n const rank =

```

```
xShape.length;\n if (rank > 4) {\n throw new Error(\n `WebGL backend: Reverse of rank-${rank} tensor\n is not yet supported`);\n }\n this.outputShape = xShape;\n\n if (rank === 1) {\n this.userCode = `\n\n void main() {\n int coord = getOutputCoords();\n setOutput(getX(${xShape[0]} - coord - 1));\n }\n`;\n return;\n }\n const getInCoord = (i: number) => {\n if (axis.indexOf(i)\n !== -1 && xShape[i] !== 1) {\n return `${xShape[i]} - coords[${i]} - 1`;\n }\n return `coords[${i}]`;\n};\n const inCoords = xShape.map((_, i) => getInCoord(i)).join(',')\n const type =\n getCoordsDataType(rank);\n\n this.userCode = `\n void main() {\n ${type} coords = getOutputCoords();\n setOutput(getX(${inCoords}));\n }\n`;\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

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```

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=====\n\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class ReversePackedProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(xShape: number[], axis: number[]) {\n const rank = xShape.length;\n if (rank > 4) {\n throw new Error(\n `WebGL backend: Reverse of rank-${rank} tensor\n is not yet supported`);\n }\n this.outputShape = xShape;\n const channels = getChannels('rc', rank);\n const\n nextColumn = `${channels[rank - 1]} + 1 < ${this.outputShape[rank - 1]}`;\n const\n nextRow = `${channels[rank - 2]} + 1 < ${this.outputShape[rank - 2]}`;\n const type = getCoordsDataType(rank);\n if (rank === 1) {\n this.userCode = `\n\n void main(){\n int rc = getOutputCoords();\n vec4 result = vec4(0.); \n result.r = getChannel(getX(${xShape[0]} - rc - 1),\n ${xShape[0]} - rc - 1);\n if (${nextColumn}){\n result.g = getChannel(getX(${xShape[0]} - (rc + 1) - 1),\n ${xShape[0]} - (rc + 1) - 1);\n }\n setOutput(result);\n }\n`;\n } else {\n this.userCode = `\n\n void main() {\n ${type} rc =\n getOutputCoords();\n vec4 result = vec4(0.); \n result.r = ${getR(channels.slice());}\n if (${nextColumn}){\n result.g = ${getG(channels.slice());}\n }\n if (${nextRow}) {\n result.b = ${getB(channels.slice());}\n if (${nextColumn}) {\n result.a = ${getA(channels.slice());}\n }\n }\n setOutput(result);\n }\n`;\n }\n\n function getR(channels: string[]): string {\n return getChannel(channels);\n }\n\n function getG(channels: string[]): string {\n channels[rank - 1] = '(' + channels[rank - 1] + ` + 1`);\n return getChannel(channels);\n }\n\n function getB(channels: string[]): string {\n channels[rank - 2] = '(' + channels[rank - 2] + ` + 1`);\n return getChannel(channels);\n }\n\n function getA(channels: string[]): string {\n channels[rank - 1] = '(' + channels[rank - 1] + ` + 1`);\n channels[rank - 2] = '(' + channels[rank - 2] + ` + 1`);\n return getChannel(channels);\n }\n\n function getChannel(channels: string[]): string {\n const inCoordsArray = xShape.map((_, i) => getInCoord(i, channels));\n const inCoords = inCoordsArray.join(',')\n const innerDims = inCoordsArray.slice(-2).join(',')\n return `getChannel(getX(${inCoords}), vec2(${innerDims}))`;\n }\n\n function getInCoord(i: number, channels1: string[]): string {\n if (axis.indexOf(i)\n !== -1 && xShape[i] !== 1) {\n return `${xShape[i]} - ${channels1[i]} - 1`;\n } else {\n return\n `${channels1[i]}`;\n }\n }\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {env, KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\n\nimport\n {MathBackendWebGL} from '../backend_webgl';\n\nimport {ReverseProgram} from '../reverse_gpu';\n\nimport\n {ReversePackedProgram} from '../reverse_packed_gpu';\n\nimport {identity} from './Identity';\n\n\nexport function\n reverse(args: {\n inputs: ReverseInputs,\n backend: MathBackendWebGL,\n attrs: ReverseAttrs\n}): TensorInfo\n {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} = attrs;\n\n const xRank =\n x.shape.length;\n\n const $dims = util.parseAxisParam(dims, x.shape);\n\n if (xRank === 0) {\n return\n identity({inputs: {x}, backend});\n }\n\n const program =\n env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new ReversePackedProgram(x.shape, $dims) :\n new ReverseProgram(x.shape, $dims);\n\n return backend.runWebGLProgram(program, [x,\n x.dtype]);\n }\n\n\nexport const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'webgl',\n kernelFunc: reverse as {} as KernelFunc\n};\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *\n\n\n=====\n\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from\n '../gpgpu_math';\n\n\nexport class RotateProgram implements GPGPUProgram {\n variableNames = ['Image'];\n\n outputShape: number[] = [];\n\n userCode: string;\n\n constructor(\n imageShape: [number, number, number,\n number], radians: number,\n fillValue: number|[number, number, number],\n center: number|[number,\n number]) {\n const imageHeight = imageShape[1];\n const imageWidth = imageShape[2];\n const sinFactor =\n Math.sin(radians).toFixed(3);\n const cosFactor = Math.cos(radians).toFixed(3);\n this.outputShape =\n imageShape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight,\n imageWidth);\n\n const centerXString = centerX.toFixed(3);\n const centerYString = centerY.toFixed(3);\n\n let\n fillSnippet = \";\n\n if (typeof fillValue === 'number') {\n fillSnippet = `float outputValue =\n ${fillValue.toFixed(2)};`;\n }\n else {\n fillSnippet = `\n vec3 fill = vec3(${fillValue.join(',')});\n float\n outputValue = fill[coords[3]];`;\n }\n\n this.userCode = `\n void main() {\n ivec4 coords =\n getOutputCoords();\n int x = coords[2];\n int y = coords[1];\n float coordXFloat\n = (float(x) - ${centerXString}) * ${\n cosFactor} - (float(y) - ${centerYString}) * ${sinFactor};\n float\n coordYFloat = (float(x) - ${centerXString}) * ${\n sinFactor} + (float(y) - ${centerYString}) * ${cosFactor};\n\n int coordX = int(round(coordXFloat + ${centerXString}));\n int coordY = int(round(coordYFloat +\n ${centerYString}));\n\n ${fillSnippet}\n\n if(coordX >= 0 && coordX < ${imageWidth} && coordY >= 0\n && coordY < ${\n imageHeight}) {\n outputValue = getImage(coords[0], coordY, coordX, coords[3]);\n\n }\n\n setOutput(outputValue);\n }\n }\n\n`, /**\n * @license\n * Copyright 2020 Google LLC.\n * All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by\n * applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *\n\n\n=====\n\n*\n\nimport {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {RotateWithOffset,
```

```

RotateWithOffsetAttrs, RotateWithOffsetInputs } from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL}
from '../backend_webgl';\nimport {RotateProgram} from '../rotate_gpu';\n\nexport const rotateWithOffsetConfig:
KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'webgl',\n kernelFunc: ({inputs, attrs,
backend}) => {\n const {image} = inputs as RotateWithOffsetInputs;\n const {radians, fillValue, center} = attrs
as {\n as RotateWithOffsetAttrs;\n const webglBackend = backend as MathBackendWebGL;\n\n const program = new RotateProgram(\n (image as Tensor4D).shape, radians, fillValue, center);\n const
output = webglBackend.runWebGLProgram(program, [image], image.dtype);\n return output;\n };\n};\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport
{unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst ROUND = ` \n // OpenGL ES does not
support round function.\n // The algorithm is based on banker's rounding.\n float base = floor(x);\n if ((x - base) <
0.5) {\n return floor(x);\n } else if ((x - base) > 0.5) {\n return ceil(x);\n } else {\n if (mod(base, 2.0) == 0.0)
{\n return base;\n } else {\n return base + 1.0;\n }\n }\n`;\n\nexport const round =
unaryKernelFunc({opSnippet: ROUND});\n\nexport const roundConfig: KernelConfig = {\n kernelName:
Round,\n backendName: 'webgl',\n kernelFunc: round,\n};\n"/**\n * @license\n * Copyright 2018 Google LLC.
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in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'/shader_compiler';\n\nexport class ScatterProgram implements GPGPUProgram {\n variableNames = ['updates',
'indices', 'defaultValue'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n updateSize: number,\n sliceDim: number, indicesRank: number,\n updatesRank: number, strides: number[], shape: number[],\n summingDupeIndex = true) {\n this.outputShape = shape;\n const stridesType =
getCoordsDataType(strides.length);\n const dtype = getCoordsDataType(shape.length);\n let indicesString = ";\n if (indicesRank
=== 1) {\n indicesString = 'i';\n } else if (indicesRank === 2) {\n indicesString = 'i, j';\n }\n const
indicesSnippet = `getIndices(${indicesString})`;\n\n let updatesString = ";\n if (updatesRank === 1) {\n updatesString = 'i';\n } else if (updatesRank === 2) {\n updatesString = 'i, coords[1]';\n }\n const
updatesSnippet = `getUpdates(${updatesString})`;\n\n const strideString = sliceDim > 1 ? 'strides[j]' : 'strides';\n this.userCode = `\n ${stridesType} strides = ${stridesType}(${strides});\n\n void main() {\n ${dtype}
coords = getOutputCoords();\n float sum = 0.0;\n bool found = false;\n for (int i = 0; i <
${updateSize}; i++) {\n int flattenedIndex = 0;\n for (int j = 0; j < ${sliceDim}; j++) {\n int
index = round(${indicesSnippet});\n flattenedIndex += index * ${strideString};\n }\n if
(flattenedIndex == coords[0])\n {\n sum += ${updatesSnippet};\n found = true;\n }\n }\n }\n `;\n }\n\n setOutput(mix(getDefaultValue(), sum, float(found)));\n};\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *

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=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, ScatterNd, ScatterNdAttrs,
 ScatterNdInputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { ScatterProgram } from './scatter_gpu';\n\nimport { reshape } from './Reshape';\n\n\nexport
function scatterNd(args: {\n inputs: ScatterNdInputs,\n backend: MathBackendWebGL,\n attrs:
 ScatterNdAttrs\n}): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { indices, updates } = inputs;\n const { shape } = attrs;\n const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n backend_util.calculateShapes(updates, indices, shape);\n const flattenShape = [outputSize / sliceSize,
 sliceSize];\n if (outputSize === 0) {\n return backend.makeTensorInfo(shape, indices.dtype);\n }\n const
 flattenIndices = reshape(\n inputs: { x: indices }, backend, attrs: { shape: [numUpdates, sliceRank] });\n const
 flattenX = reshape(\n inputs: { x: updates }, backend, attrs: { shape: [numUpdates, sliceSize] });\n const
 defaultValue = backend.makeTensorInfo(\n
 [], 'float32', new Float32Array([0])); // scalar(0)\n const program = new ScatterProgram(\n numUpdates,
 sliceRank, flattenIndices.shape.length, flattenX.shape.length,\n strides, flattenShape);\n const res =
 backend.runWebGLProgram(\n program, [flattenX, flattenIndices, defaultValue], flattenX.dtype);\n const
 reshaped = reshape({ inputs: { x: res }, backend, attrs: { shape } });\n backend.disposeIntermediateTensorInfo(flattenIndices);\n backend.disposeIntermediateTensorInfo(flattenX);\n backend.disposeIntermediateTensorInfo(res);\n backend.disposeIntermediateTensorInfo(defaultValue);\n return
 reshaped;\n}\n\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName:
 'webgl',\n kernelFunc: scatterNd as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC.
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 the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
 distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
 express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
 the License.\n */
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*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nimport { getCoordsDataType } from
'./shader_compiler';\n\n\nexport class SelectProgram implements GPGPUProgram {\n variableNames = ['c', 'a', 'b'];\n outputShape: number[];\n userCode: string;\n constructor(cRank: number, shape: number[], rank: number) {\n this.outputShape = shape;\n let cCoords;\n let abCoords;\n if (rank > 4) {\n throw Error(`Where for rank
 ${rank} is not yet supported`);\n }\n if (rank === 1) {\n abCoords = `resRC`;\n cCoords = `resRC`;\n } else {\n const currentCoords =
 ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];\n const cCoordVars = [];\n const abCoordVars = [];\n for (let i
 = 0; i < shape.length; i++) {\n abCoordVars.push(`${currentCoords[i]}`);\n if (i < cRank) {\n
 cCoordVars.push(`${currentCoords[i]}`);\n }\n }\n cCoords = cCoordVars.join();\n abCoords =
 abCoordVars.join();\n }\n const dtype = getCoordsDataType(rank);\n this.userCode =`\n
 void main()\n {\n ${dtype} resRC = getOutputCoords();\n float cVal = getC(${cCoords});\n if (cVal >= 1.0) {\n
 setOutput(getA(${abCoords}));\n } else {\n setOutput(getB(${abCoords}));\n }\n }\n `;\n
 }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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 not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, TensorInfo, upcastType } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { SelectProgram } from '../select_gpu';\n\nexport function select(args: { inputs: SelectInputs, backend: MathBackendWebGL }):\n TensorInfo {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n\n const program =\n new SelectProgram(condition.shape.length,\n t.shape, t.shape.length);\n return backend.runWebGLProgram(\n program, [condition, t, e], upcastType(t.dtype,\n e.dtype));\n }\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'webgl',\n kernelFunc: select as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { backend_util, KernelConfig, Selu } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\n\nconst SELU =`\n // Stable and Attracting Fixed Point (0, 1) for Normalized Weights.\n // see: https://arxiv.org/abs/1706.02515\n float scaleAlpha =\n ${backend_util.SELU_SCALEALPHA};\n float scale = ${backend_util.SELU_SCALE};\n return (x >= 0.0) ?\n scale * x : scaleAlpha * (exp(x) - 1.0);\n`;\n\nexport const selu = unaryKernelFunc({ opSnippet: SELU });\n\nexport const seluConfig: KernelConfig = {\n kernelName: Selu,\n backendName: 'webgl',\n kernelFunc: selu,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, Sigmoid } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\n\nconst SIGMOID =`\n return 1.0 / (1.0 + exp(-1.0 * x));\n`;\n\nexport const sigmoid = unaryKernelFunc({ opSnippet: SIGMOID });\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: Sigmoid,\n backendName: 'webgl',\n kernelFunc: sigmoid,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport { KernelConfig, Sign } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\n\n// Sign does not propagate NaNs.\nconst SIGN =`\n if (isnan(x)) { return 0.0; }\n return sign(x);\n`;\n\nexport const sign = unaryKernelFunc({ opSnippet: SIGN });\n\nexport const signConfig: KernelConfig = {\n kernelName: Sign,\n backendName: 'webgl',\n kernelFunc: sign,\n};\n\n"/**\n *
```

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```
=====\n*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {CHECK_NAN_SNIPPET_UNARY, unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\nconst SIN = CHECK_NAN_SNIPPET_UNARY +\n\nreturn sin(x);\n\nexport const sin = unaryKernelFunc({opSnippet: SIN});\nexport const sinConfig: KernelConfig = {\n kernelName: Sin,\n backendName: 'webgl',\n kernelFunc: sin,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {KernelConfig, Sinh} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\nconst SINH = \n float e2x = exp(x);\n return (e2x - 1.0 / e2x) / 2.0;\n\nexport const sinh = unaryKernelFunc({opSnippet: SINH});\nexport const sinhConfig: KernelConfig = {\n kernelName: Sinh,\n backendName: 'webgl',\n kernelFunc: sinh,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {KernelConfig, Softplus} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\nconst SOFTPLUS = \n float epsilon = 1.1920928955078125e-7;\n float threshold = log(epsilon) + 2.0;\n bool too_large = x > threshold;\n bool too_small = x < threshold;\n float result;\n float exp_x = exp(x);\n if (too_large){\n result = x;\n } else if (too_small){\n result = exp_x;\n } else{\n result = log(exp_x + 1.0);\n }\n return result;\n\nexport const softplus = unaryKernelFunc({opSnippet: SOFTPLUS});\nexport const softplusConfig: KernelConfig = {\n kernelName: Softplus,\n backendName: 'webgl',\n kernelFunc: softplus,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {padV2} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\nexport const spaceToBatchND = (args: {\n inputs: SpaceToBatchNDInputs,\n backend:
```



```

MathBackendWebGL,\n attrs: SpaceToBatchNDAAttrs\n): TensorInfo => {\n const {inputs, backend, attrs} =
args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n util.assert(\n x.shape.length <= 4,\n () => 'spaceToBatchND for rank > 4 with a WebGL backend not ' +\n 'implemented
yet');\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const completePaddings: Array<[number, number]>
= [[0, 0]];\n completePaddings.push(...paddings as Array<[number, number]>);\n for (let i = 1 +
blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const toDispose = [];\n\n const paddedX = padV2({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue:
0}\n });\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod,
false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n
reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapedPaddedX =
reshape(\n {inputs: {x: paddedX}, backend, attrs: {shape: reshapedPaddedShape}});\n\n const paddedXT =
transpose({\n inputs: {x: reshapedPaddedX},\n
 backend,\n attrs: {perm: permutedReshapedPaddedPermutation}\n });\n\n const result =\n reshape({inputs:
{x: paddedXT}, backend, attrs: {shape: flattenShape}});\n\n toDispose.push(paddedX);\n
toDispose.push(reshapedPaddedX);\n toDispose.push(paddedXT);\n\n toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n return result;\n};\n\nexport const spaceToBatchNDConfig:
KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'webgl',\n kernelFunc: spaceToBatchND as
{\n } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, SparseToDense, SparseToDenseAttrs,
SparseToDenseInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {ScatterProgram} from './scatter_gpu';\n\nimport {reshape} from './Reshape';\n\nexport
function sparseToDense(args: {\n inputs: SparseToDenseInputs,\n backend: MathBackendWebGL,\n attrs:
SparseToDenseAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {sparseIndices,
sparseValues, defaultValue} = inputs;\n const {outputShape} = attrs;\n\n const {sliceRank, numUpdates, strides,
outputSize} =\n backend_util.calculateShapes(sparseValues, sparseIndices, outputShape);\n\n const
sumDupeIndices = false;\n\n const program = new ScatterProgram(\n numUpdates, sliceRank, sparseIndices.shape.length,\n
sparseValues.shape.length, strides, [outputSize, 1], sumDupeIndices);\n\n const res =
backend.runWebGLProgram(\n program, [sparseValues, sparseIndices, defaultValue], sparseValues.dtype);\n\n
const reshaped =\n reshape({inputs: {x: res}, backend, attrs: {shape: outputShape}});\n\n
backend.disposeIntermediateTensorInfo(res);\n\n return reshaped;\n}\n\nexport const sparseToDenseConfig:
KernelConfig = {\n kernelName: SparseToDense,\n backendName: 'webgl',\n kernelFunc: sparseToDense as {\n } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====

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*\n\nimport {backend_util, KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {slice} from
'./Slice';\n\nexport function splitV(\n args:\n {inputs: SplitVInputs, backend: MathBackendWebGL, attrs:
SplitVAttrs});\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const
{numOrSizeSplits, axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n\n const xRank = x.shape.length;\n const
begin = new Array(xRank).fill(0);\n const size = x.shape.slice();\n\n return splitSizes.map(s => {\n const
sliceSize = [...size];\n sliceSize[$axis] = s;\n const sliceT =\n slice({inputs: {x}, backend, attrs: {begin, size:
sliceSize}});\n begin[$axis] += s;\n return sliceT;\n });\n\n\nexport const splitVConfig: KernelConfig = {\n
kernelName: SplitV,\n backendName: 'webgl',\n kernelFunc: splitV as { } as KernelFunc\n};\n", "/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, Sqrt} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst Sqrt = `return sqrt(x);`;\n\nexport const sqrt =
unaryKernelFunc({opSnippet: Sqrt});\n\nexport const sqrtConfig: KernelConfig = {\n kernelName: Sqrt,\n backendName: 'webgl',\n kernelFunc: sqrt as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may
not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst SQUARE = `return x * x;`;\n\nexport const square =
unaryKernelFunc({opSnippet: SQUARE});\n\nexport const squareConfig: KernelConfig = {\n kernelName:
Square,\n backendName: 'webgl',\n kernelFunc: square,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, TensorInfo, UnaryInputs} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {CHECK_NAN_SNIPPET,
UnaryOpProgram} from './unaryop_gpu';\n\nexport function step(\n {inputs, attrs, backend};\n {inputs:
UnaryInputs, attrs: StepAttrs, backend: MathBackendWebGL});\n TensorInfo {\n const {x} = inputs;\n const
opSnippet = CHECK_NAN_SNIPPET + `\n return x > 0.0 ? 1.0 : float(${attrs.alpha});\n `;\n\n const program =
new UnaryOpProgram(x.shape, opSnippet);\n\n return backend.runWebGLProgram(program, [x],
x.dtype);\n};\n\n\nexport const
stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'webgl',\n kernelFunc: step as { } as
KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the

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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class StridedSliceProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n constructor(begin: number[], strides: number[], size: number[]) {\n this.outputShape = size;\n const rank = size.length;\n const inputDtype = getCoordsDataType(size.length);\n const dtype = getCoordsDataType(size.length);\n\n let newCoords = \";\n if (rank === 1) {\n newCoords = 'coords * strides + begin';\n } else {\n let outputAxis = 0;\n newCoords =\n size.map((_, i) => {\n outputAxis++;\n return size.length === 1 ?\n `coords * strides[${i}] + begin[${i}]`\n : `coords[${outputAxis - 1}] * strides[${i}] + begin[${i}]`;\n }).join(',')\n }\n\n this.userCode = `\n ${inputDtype} begin = ${inputDtype}(${begin});\n ${inputDtype} strides = ${inputDtype}(${strides});\n\n void main() {\n ${dtype} coords =\n getOutputCoords();\n setOutput(getX(${newCoords}));\n }\n `;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====
*\n\nimport {buffer, KernelConfig, KernelFunc, Rank, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorBuffer, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {stridedSliceImplCPU} from './kernel_utils/shared';\nimport {StridedSliceProgram} from './strided_slice_gpu';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nexport function stridedSlice(args: {\n inputs: StridedSliceInputs,\n backend: MathBackendWebGL,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {begin, end, strides, beginMask, endMask, ellipsisMask, newAxisMask, shrinkAxisMask} = attrs;\n const {nonStrided, $begin, $strides, size, newShape, outShape} =\n slice_util.sliceInfo(x.shape, begin, end, strides, beginMask, endMask, ellipsisMask, newAxisMask, shrinkAxisMask);\n const $x = reshape({inputs: {x}, backend, attrs: {shape: newShape}});\n let result;\n if (nonStrided) {\n const sliced =\n slice({inputs: {x: $x}, backend, attrs: {begin: $begin, size}});\n result = reshape({inputs: {x: sliced}, backend, attrs: {shape: outShape}});\n backend.disposeIntermediateTensorInfo(sliced);\n } else if (outShape.some(axis => axis === 0)) {\n result = backend.makeTensorInfo(outShape, x.dtype, []);\n } else {\n const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([$x]);\n if (shouldExecuteOnCPU) {\n const xTexData = backend.texData.get($x.dataId);\n const values = xTexData.values as TypedArray;\n const xBuf = buffer($x.shape, $x.dtype, values) as TensorBuffer<Rank>;\n const resultValues =\n stridedSliceImplCPU(outShape, xBuf, $strides, $begin);\n result = backend.makeTensorInfo(outShape, $x.dtype, resultValues);\n } else {\n const program = new StridedSliceProgram($begin, $strides, outShape);\n result = backend.runWebGLProgram(program, [$x], $x.dtype);\n }\n }\n const resultReshaped =\n reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});\n backend.disposeIntermediateTensorInfo($x);\n}
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backend.disposeIntermediateTensorInfo(result);\n\n return resultReshaped;\n}\n\nexport const stridedSliceConfig:
KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'webgl',\n kernelFunc: stridedSlice as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*/\n\nimport { KernelConfig,
Tan } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from './kernel_utils/kernel_funcs_utils';\n\nconst
TAN = `return tan(x);`\n\nexport const tan = unaryKernelFunc({opSnippet: TAN});\n\nexport const tanConfig:
KernelConfig = {\n kernelName: Tan,\n backendName: 'webgl',\n kernelFunc: tan,\n};\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport { KernelConfig, Tanh } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'./kernel_utils/kernel_funcs_utils';\n\nconst TANH = `\n float e2x = exp(-2.0 * abs(x));\n return sign(x) * (1.0 -
e2x) / (1.0 + e2x);\n `;\n\nexport const tanh = unaryKernelFunc({opSnippet: TANH});\n\nexport const tanhConfig:
KernelConfig = {\n kernelName: Tanh,\n backendName: 'webgl',\n kernelFunc: tanh,\n};\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nimport { getCoordsDataType } from
'./shader_compiler';\n\nexport class TileProgram implements GPGPUProgram {\n variableNames = ['A'];\n
outputShape: number[];\n userCode: string;\n rank: number;\n\n constructor(aShape: number[], reps: number[])
{\n const outputShape: number[] = new Array(aShape.length);\n for (let i = 0; i < outputShape.length; i++) {\n
outputShape[i] = aShape[i] * reps[i];\n }\n this.outputShape = outputShape;\n this.rank =
outputShape.length;\n const dtype = getCoordsDataType(this.rank);\n const sourceCoords =
getSourceCoords(aShape);\n\n this.userCode = `\n void main() {\n ${dtype} resRC = getOutputCoords();\n
setOutput(getA(${sourceCoords}));\n }\n `;\n }\n\nfunction getSourceCoords(aShape:
number[]): string {\n const rank = aShape.length;\n if (rank > 5) {\n throw Error(`Tile for rank ${rank} is not yet
supported`);\n }\n if (rank === 1) {\n return `imod(resRC, ${aShape[0]}`);\n }\n\n const currentCoords =
[`resRC.x`, `resRC.y`, `resRC.z`, `resRC.w`, `resRC.u`];\n\n const sourceCoords = [];\n for (let i = 0; i <
aShape.length; i++) {\n sourceCoords.push(`imod(${currentCoords[i]}, ${aShape[i]}`);\n }\n\n return
sourceCoords.join();\n }\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed

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```
=====\n*\n\nimport {buffer, KernelConfig, KernelFunc, TensorInfo, Tile, TileAttrs, TileInputs, util} from\n '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {tileImplCPU} from\n '../kernel_utils/shared';\nimport {TileProgram} from './tile_gpu';\n\nexport function tile(\n params: {inputs:\n TileInputs, backend: MathBackendWebGL, attrs: TileAttrs});\n TensorInfo {\n const {inputs, backend, attrs} =\n params;\n const {x} = inputs;\n const {reps} = attrs;\n\n if (x.dtype === 'string') {\n // Even though string tensor\n is always on CPU, just to be consistent on how\n // to access tensor data.\n const data =\n backend.readSync(x.dataId) as Uint8Array[];\n const decodedData = data.map(d => util.decodeString(d));\n\n const buf = buffer(x.shape,\n x.dtype, decodedData);\n const outBuf = tileImplCPU(buf, reps);\n return\n backend.makeTensorInfo(outBuf.shape, outBuf.dtype, outBuf.values);\n }\n\n const program = new\n TileProgram(x.shape, reps);\n const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n return\n output;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'webgl',\n kernelFunc: tile as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, NumericDataType, TensorInfo, TopK, TopKAttrs, TopKInputs,\n TypedArray} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport\n {topKImplCPU} from '../kernel_utils/shared';\n\nexport function topK(\n args: {inputs: TopKInputs, backend:\n MathBackendWebGL, attrs: TopKAttrs});\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {x} =\n inputs;\n const {k, sorted} = attrs;\n\n const xVals = backend.readSync(x.dataId) as TypedArray;\n const\n [allTopKVals, allTopKIndices] =\n topKImplCPU(xVals, x.shape, x.dtype as NumericDataType, k, sorted);\n\n return [\n backend.makeTensorInfo(\n allTopKVals.shape, allTopKVals.dtype, allTopKVals.values),\n backend.makeTensorInfo(\n allTopKIndices.shape, allTopKIndices.dtype, allTopKIndices.values)\n];\n}\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'webgl',\n kernelFunc: topK as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n *
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```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unique, UniqueAttrs, UniqueInputs} from '@tensorflow/tfjs-\n core';\nimport {MathBackendWebGL}\n from '../backend_webgl';\nimport {uniqueImplCPU} from '../kernel_utils/shared';\nimport {assertNotComplex}\n from '../webgl_util';\n\nexport function unique(\n args: {\n inputs: UniqueInputs, attrs: UniqueAttrs, backend:\n MathBackendWebGL});\n TensorInfo[] {\n const {inputs, attrs, backend} = args;\n const {axis} = attrs;\n const\n {x} = inputs;\n assertNotComplex(x, 'unique');\n\n // For now, always forward calculation to the CPU backend.\n console.warn(\n 'WARNING: ',\n 'UI might be locked temporarily as data is being downloaded');\n const\n
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values = backend.readSync(x.dataId);\n const {outputValues, outputShape, indices} =\n uniqueImplCPU(values,\n axis, x.shape, x.dtype);\n return [\n backend.makeTensorInfo(outputShape, x.dtype, outputValues),\n backend.makeTensorInfo([indices.length], 'int32', indices),\n];\n\n\nexport const uniqueConfig: KernelConfig =\n {\n kernelName: Unique,\n backendName: 'webgl',\n kernelFunc: unique as {\n as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *

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*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from\n '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {reshape} from\n './Reshape';\nimport {slice} from './Slice';\n\nexport function\n unpack(\n args:\n {inputs: UnpackInputs, backend: MathBackendWebGL, attrs: UnpackAttrs});\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <\n 0) {\n axis += value.shape.length;\n }\n\n const x = value;\n const xRank = x.shape.length;\n\n const num =\n value.shape[axis];\n const outShape: number[] = new Array(xRank - 1);\n let outIndex = 0;\n for (let i = 0; i <\n xRank; i++) {\n if (i !== axis) {\n outShape[outIndex++] = x.shape[i];\n }\n }\n\n const toDispose = [];\n\n const begin = new Array(xRank).fill(0);\n const size = x.shape.slice();\n size[axis] = 1;\n const res: TensorInfo[] =\n new Array(num);\n for (let i = 0; i < res.length; i++) {\n begin[axis] = i;\n const sliced = slice({inputs: {x},\n backend, attrs: {begin, size}});\n const reshaped =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:\n outShape}});\n res[i] = reshaped;\n\n toDispose.push(sliced);\n }\n\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return res;\n}\n\n\nexport const\n unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'webgl',\n kernelFunc: unpack as {\n as KernelFunc\n};\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *

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*\n\nimport {backend_util} from\n '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class SegmentOpProgram\n implements GPGPUProgram {\n variableNames = ['x', 'segmentIds'];\n outputShape: number[];\n userCode:\n string;\n\n constructor(\n segOpInfo: backend_util.segment_util.SegOpInfo,\n segOpType:\n 'unsortedSegmentSum') {\n const windowSize = segOpInfo.windowSize;\n const batchSize =\n segOpInfo.batchSize;\n const inSize = segOpInfo.inSize;\n const numSegments = segOpInfo.numSegments;\n const outSize = numSegments * Math.ceil(inSize / windowSize);\n this.outputShape = [batchSize, outSize];\n\n const initializationValue = '0.0';\n const returnValue = `sumValue`;\n\n const windowSizeNearestVec4 =\n Math.floor(windowSize / 4) * 4;\n const windowSizeVec4Remainder = windowSize % 4;\n\n const\n updateSnippet = `\n sumValue += dot(values, segFilter);\n `;\n\n let checkValueOutOfBounds = ";\n if\n (inSize % windowSize > 0) {\n checkValueOutOfBounds\n = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return initializationValue;\n }\n `;\n }\n\n let\n checkSegmentIdOutOfBounds = ";\n if (inSize % windowSize > 0) {\n checkSegmentIdOutOfBounds = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return -1.0;\n }\n `;\n }\n\n this.userCode = `\n const float

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initializationValue = ${initializationValue};\n\n float getValue(int batch, int inIdx) {\n
${checkValueOutOfBounds}\n return getX(batch, inIdx);\n }\n\n float getSegmentIdAtIndex(int inIdx)
{\n ${checkSegmentIdOutOfBounds}\n return getSegmentIds(inIdx);\n }\n\n void main() {\n
ivec2 coords = getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n int inOffset =
int(floor(float(outIdx) / float(\n ${numSegments})) * float(${windowSize}));\n int currentSeg =
int(mod(float(outIdx), float(${numSegments})));
float sumValue = 0.0;\n for (int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n int inIdx =
inOffset + i;\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n
getValue(batch, inIdx + 2),\n getValue(batch, inIdx + 3)\n);\n\n vec4 segFilter = vec4(\n
int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 2)) == currentSeg ? 1 : 0,\n
int(getSegmentIdAtIndex(inIdx + 3)) == currentSeg ? 1 : 0\n);\n\n ${updateSnippet}\n }\n\n int
inIdx = inOffset + ${windowSizeNearestVec4};\n if (${windowSizeVec4Remainder} == 1) {\n vec4
values = vec4(\n getValue(batch, inIdx),\n initializationValue,\n initializationValue,\n
initializationValue\n);\n\n int inIdxSeg = int(getSegmentIdAtIndex(inIdx));\n\n vec4 segFilter = vec4(\n
int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n 0,\n 0,\n 0\n);\n\n
${updateSnippet}\n } else if (${windowSizeVec4Remainder} == 2) {\n vec4 values = vec4(\n
getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n initializationValue,\n
initializationValue\n);\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n 0,\n 0\n
);\n\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder} == 3) {\n vec4 values =
vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n
initializationValue\n);\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n
int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 2)) ==
currentSeg ? 1 : 0,\n 0\n);\n\n ${updateSnippet}\n }\n\n setOutput(${returnValue});\n
}\n\n `;\n }\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, DataType, KernelConfig, KernelFunc, sumOutType, TensorInfo,
UnsortedSegmentSum, UnsortedSegmentSumAttrs, UnsortedSegmentSumInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {SegmentOpProgram} from
'./segment_gpu';\n\nimport {range} from './Range';\n\nimport {reshape} from './Reshape';\n\nimport {tile} from
'./Tile';\n\nimport {transpose} from './Transpose';\n\nexport function unsortedSegmentSum(args: {\n inputs:
UnsortedSegmentSumInputs,\n backend: MathBackendWebGL,\n attrs: UnsortedSegmentSumAttrs\n}):
TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x, segmentIds} = inputs;\n const {numSegments} =
attrs;\n\n const xRank = x.shape.length;\n\n const toDispose = [];\n\n let axis = 0;\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n\n let
permutedX = x;\n if (permutation != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm:
permutation}});\n toDispose.push(permutedX);\n axis = backend_util.getInnerMostAxes(1, xRank)[0];\n }\n\n
const outShape = backend_util.segment_util.computeOutShape(\n permutedX.shape, axis, numSegments);\n
const inSize = util.sizeFromShape([permutedX.shape[axis]]);\n const a2D =\n reshape({inputs: {x: permutedX},

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backend, attrs: {shape: [-1, inSize]}));\n toDispose.push(a2D);\n\n const outputDType =
sumOutType(x.dtype);\n\n const segOpCompute =\n (x: TensorInfo, segOpType: 'unsortedSegmentSum',
segmentIds: TensorInfo,\n dtype: DataType, numSegments: number): TensorInfo => {\n const batchSize =
x.shape[0];\n const inSize = x.shape[1];\n const windowSize =\nbackend_util.segment_util.segOpComputeOptimalWindowSize(\n inSize, numSegments);\n const
segOpInfo = {windowSize, inSize, batchSize, numSegments};\n
 const program = new SegmentOpProgram(segOpInfo, segOpType);\n const output =
backend.compileAndRun(program, [x, segmentIds], dtype);\n toDispose.push(output);\n // No need to run
another GPGPU program.\n if (output.shape[1] === numSegments) {\n return output;\n }\n const
rangeInfo = range({\n backend,\n attrs: {start: 0, stop: numSegments, step: 1, dtype: 'float32'}\n });\n
 const tileInfo = tile({\n inputs: {x: rangeInfo},\n backend,\n attrs: {reps: [inSize /
windowSize]}\n });\n toDispose.push(rangeInfo);\n toDispose.push(tileInfo);\n const result =\n segOpCompute(output, segOpType, tileInfo, dtype, numSegments);\n return result;\n });\n\n const
segOpResult = segOpCompute(\n a2D, 'unsortedSegmentSum', segmentIds, outputDType, numSegments);\n\n const
reshaped =\n reshape({inputs: {x: segOpResult},
backend, attrs: {shape: outShape}});\n\n let result = reshaped;\n if (permutation != null) {\n
toDispose.push(reshaped);\n const perm = backend_util.getUndoAxesPermutation(permutation);\n result =
transpose({inputs: {x: result}, backend, attrs: {perm}});\n }\n\n toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n return result;\n}\n\nexport const unsortedSegmentSumConfig:
KernelConfig = {\n kernelName: UnsortedSegmentSum,\n backendName: 'webgl',\n kernelFunc:
unsortedSegmentSum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {_fusedMatMulConfig} from
'/kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {acosConfig} from
'/kernels/Acos';\nimport {acoshConfig} from './kernels/Acosh';\nimport {addConfig} from './kernels/Add';\nimport
{addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from
'/kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {argMinConfig} from
'/kernels/ArgMin';\nimport {asinConfig} from './kernels/Asin';\nimport {asinhConfig} from
'/kernels/Asinh';\nimport {atanConfig} from './kernels/Atan';\nimport {atan2Config} from
'/kernels/Atan2';\nimport {atanhConfig}
from './kernels/Atanh';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {avgPool3DConfig} from
'/kernels/AvgPool3D';\nimport {avgPoolGrad3DConfig} from './kernels/AvgPool3DGrad';\nimport
{avgPoolGradConfig} from './kernels/AvgPoolGrad';\nimport {batchMatMulConfig} from
'/kernels/BatchMatMul';\nimport {batchNormConfig} from './kernels/BatchNorm';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {bincountConfig} from
'/kernels/Bincount';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport
{clipByValueConfig} from './kernels/ClipByValue';\nimport {complexConfig} from './kernels/Complex';\nimport
{complexAbsConfig} from './kernels/ComplexAbs';\nimport {concatConfig} from './kernels/Concat';\nimport
{conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropFilterConfig} from
'/kernels/Conv2DBackpropFilter';\nimport {conv2DBackpropInputConfig} from
'/kernels/Conv2DBackpropInput';\nimport {conv3DConfig} from

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./kernels/Conv3D';\nimport {conv3DBackpropFilterV2Config} from './kernels/Conv3DBackpropFilterV2';\nimport
{conv3DBackpropInputConfig} from './kernels/Conv3DBackpropInputV2';\nimport {cosConfig} from
./kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
./kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {denseBincountConfig}
from './kernels/DenseBincount';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport
{depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport
{depthwiseConv2dNativeBackpropFilterConfig} from './kernels/DepthwiseConv2dNativeBackpropFilter';\nimport
{depthwiseConv2dNativeBackpropInputConfig} from './kernels/DepthwiseConv2dNativeBackpropInput';\nimport
{diagConfig} from './kernels/Diag';\nimport {dilation2DConfig} from './kernels/Dilation2D';\nimport {eluConfig}
from './kernels/Elu';\nimport {eluGradConfig} from './kernels/EluGrad';\nimport {equalConfig}
from './kernels/Equal';\nimport {erfConfig} from './kernels/Erf';\nimport {expConfig} from './kernels/Exp';\nimport
{expandDimsConfig} from './kernels/ExpandDims';\nimport {expm1Config} from './kernels/Expm1';\nimport
{fftConfig} from './kernels/FFT';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
./kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
./kernels/FloorDiv';\nimport {fromPixelsConfig} from './kernels/FromPixels';\nimport {fusedConv2DConfig} from
./kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
./kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{ifftConfig} from './kernels/IFFT';\nimport {imagConfig} from './kernels/Imag';\nimport
{isFiniteConfig} from './kernels/IsFinite';\nimport {isInfConfig} from './kernels/IsInf';\nimport {isNaNConfig}
from './kernels/IsNaN';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from
./kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {linSpaceConfig} from
./kernels/LinSpace';\nimport {logConfig} from './kernels/Log';\nimport {log1pConfig} from
./kernels/Log1p';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {logicalNotConfig} from
./kernels/LogicalNot';\nimport {logicalOrConfig} from './kernels/LogicalOr';\nimport {LRNConfig} from
./kernels/LRN';\nimport {LRNGradConfig} from './kernels/LRNGrad';\nimport {maxConfig} from
./kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from
./kernels/MaxPool';\nimport {maxPool3DConfig} from './kernels/MaxPool3D';\nimport {maxPoolGrad3DConfig}
from './kernels/MaxPool3DGrad';\nimport {maxPoolGradConfig} from './kernels/MaxPoolGrad';\nimport
{maxPoolWithArgmaxConfig} from './kernels/MaxPoolWithArgmax';\nimport {meanConfig} from
./kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {modConfig} from
./kernels/Mod';\nimport {multinomialConfig} from './kernels/Multinomial';\nimport {multiplyConfig} from
./kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport
{prodConfig} from './kernels/Prod';\nimport {rangeConfig} from './kernels/Range';\nimport {realConfig} from
./kernels/Real';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reciprocalConfig} from
./kernels/Reciprocal';\nimport {reluConfig} from './kernels/Relu';\nimport {relu6Config} from
./kernels/Relu6';\nimport {reshapeConfig} from './kernels/Reshape';\nimport {resizeBilinearConfig} from
./kernels/ResizeBilinear';\nimport {resizeBilinearGradConfig} from './kernels/ResizeBilinearGrad';\nimport
{resizeNearestNeighborConfig} from './kernels/ResizeNearestNeighbor';\nimport
{resizeNearestNeighborGradConfig} from './kernels/ResizeNearestNeighborGrad';\nimport {reverseConfig} from

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./kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport
{seluConfig} from './kernels/Selu';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {signConfig} from
./kernels/Sign';\nimport {sinConfig} from './kernels/Sin';\nimport {sinhConfig} from './kernels/Sinh';\nimport
{sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from './kernels/Softmax';\nimport {softplusConfig}
from './kernels/Softplus';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport
{sparseToDenseConfig} from './kernels/SparseToDense';\nimport {splitVConfig} from './kernels/SplitV';\nimport
{sqrtConfig} from './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport
{squaredDifferenceConfig} from './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport
{stridedSliceConfig} from './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig}
from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig}
from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transposeConfig} from
./kernels/Transpose';\nimport {uniqueConfig} from './kernels/Unique';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {unsortedSegmentSumConfig} from './kernels/UnsortedSegmentSum';\nimport
{zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst kernelConfigs:
KernelConfig[] = [\n LRNConfig,\n LRNGradConfig,\n _fusedMatMulConfig,\n absConfig,\n acosConfig,\n acoshConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n argMinConfig,\n asinConfig,\n asinhConfig,\n atan2Config,\n atanConfig,\n atanhConfig,\n avgPool3DConfig,\n avgPoolConfig,\n avgPoolGrad3DConfig,\n avgPoolGradConfig,\n batchMatMulConfig,\n batchNormConfig,\n batchToSpaceNDConfig,\n bincountConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n complexAbsConfig,\n complexConfig,\n concatConfig,\n conv2DBackpropFilterConfig,\n conv2DBackpropInputConfig,\n conv2DConfig,\n conv3DBackpropFilterV2Config,\n conv3DBackpropInputConfig,\n conv3DConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n denseBincountConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeBackpropFilterConfig,\n depthwiseConv2dNativeBackpropInputConfig,\n depthwiseConv2dNativeConfig,\n diagConfig,\n dilation2DConfig,\n eluConfig,\n eluGradConfig,\n equalConfig,\n erfConfig,\n expConfig,\n expandDimsConfig,\n expm1Config,\n fftConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fromPixelsConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n ifftConfig,\n imagConfig,\n isFiniteConfig,\n isInfConfig,\n isNaNConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n linSpaceConfig,\n log1pConfig,\n logConfig,\n logicalAndConfig,\n logicalNotConfig,\n logicalOrConfig,\n maxConfig,\n maxPool3DConfig,\n maxPoolConfig,\n maxPoolGrad3DConfig,\n maxPoolGradConfig,\n maxPoolWithArgmaxConfig,\n maximumConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n modConfig,\n multinomialConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realConfig,\n realDivConfig,\n reciprocalConfig,\n relu6Config,\n reluConfig,\n reshapeConfig,\n resizeBilinearConfig,\n resizeBilinearGradConfig,\n resizeNearestNeighborConfig,\n resizeNearestNeighborGradConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n roundConfig,\n rsqrtConfig,\n scatterNdConfig,\n selectConfig,\n seluConfig,\n sigmoidConfig,\n signConfig,\n sinConfig,\n sinhConfig,\n sliceConfig,\n softmaxConfig,\n softplusConfig,\n spaceToBatchNDConfig,\n sparseToDenseConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transposeConfig,\n uniqueConfig,\n unpackConfig,\n unsortedSegmentSumConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n

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registerKernel(kernelConfig);\n}\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====\n*\n\n/* tslint:disable *\n\n/** Properties of an Any. *\n\nexport declare interface IAny {\n /** Any typeUrl *\n typeUrl?: (string|null);\n /** Any value *\n value?: (Uint8Array|null);\n}\n\n/** DataType enum. *\n\nexport enum DataType {\n 'DT_INVALID' = 0,\n 'DT_FLOAT' = 1,\n 'DT_DOUBLE' = 2,\n 'DT_INT32' = 3,\n 'DT_UINT8' = 4,\n 'DT_INT16' = 5,\n 'DT_INT8' = 6,\n 'DT_STRING' = 7,\n 'DT_COMPLEX64' = 8,\n 'DT_INT64' = 9,\n 'DT_BOOL' = 10,\n 'DT_QINT8' = 11,\n 'DT_QUINT8' = 12,\n 'DT_QINT32' = 13,\n 'DT_BFLOAT16' = 14,\n 'DT_FLOAT_REF' = 101,\n 'DT_DOUBLE_REF' = 102,\n 'DT_INT32_REF' = 103,\n 'DT_UINT8_REF' = 104,\n 'DT_INT16_REF' = 105,\n 'DT_INT8_REF' = 106,\n 'DT_STRING_REF' = 107,\n 'DT_COMPLEX64_REF' = 108,\n 'DT_INT64_REF' = 109,\n 'DT_BOOL_REF' = 110,\n 'DT_QINT8_REF' = 111,\n 'DT_QUINT8_REF' = 112,\n 'DT_QINT32_REF' = 113,\n 'DT_BFLOAT16_REF' = 114\n}\n\n/** Properties of a TensorShape. *\n\nexport declare interface ITensorShape {\n /** TensorShape dim *\n dim?: (TensorShape.IDim[]|null);\n /** TensorShape unknownRank *\n unknownRank?: (boolean|null);\n}\n\nexport namespace TensorShape {\n /** Properties of a Dim. *\n export declare interface IDim {\n /** Dim size *\n size?: (number|string|null);\n /** Dim name *\n name?: (string|null);\n }\n}\n\n/** Properties of a Tensor. *\n\nexport declare interface ITensor {\n /** Tensor dtype *\n dtype?: (DataType|null);\n /** Tensor tensorShape *\n tensorShape?: (ITensorShape|null);\n /** Tensor versionNumber *\n versionNumber?: (number|null);\n /** Tensor tensorContent *\n tensorContent?: (Uint8Array|null);\n /** Tensor floatVal *\n floatVal?: (number[]|null);\n /** Tensor doubleVal *\n doubleVal?: (number[]|null);\n /** Tensor intVal *\n intVal?: (number[]|null);\n /** Tensor stringVal *\n stringVal?: (Uint8Array[]|null);\n /** Tensor scomplexVal *\n scomplexVal?: (number[]|null);\n /** Tensor int64Val *\n int64Val?: ((number | string)[]|null);\n /** Tensor boolVal *\n boolVal?: (boolean[]|null);\n /** Tensor uint32Val *\n uint32Val?: (number[]|null);\n /** Tensor uint64Val *\n uint64Val?: ((number | string)[]|null);\n}\n\n/** Properties of an AttrValue. *\n\nexport declare interface IAttrValue {\n /** AttrValue list *\n list?: (AttrValue.IListValue|null);\n /** AttrValue s *\n s?: (string|null);\n /** AttrValue i *\n i?: (number|string|null);\n /** AttrValue f *\n f?: (number|null);\n /** AttrValue b *\n b?: (boolean|null);\n /** AttrValue type *\n type?: (DataType|null);\n /** AttrValue shape *\n shape?: (ITensorShape|null);\n /** AttrValue tensor *\n tensor?: (ITensor|null);\n /** AttrValue placeholder *\n placeholder?: (string|null);\n}\n\n/** AttrValue\n func *\n func?: (INameAttrList|null);\n}\n\nexport namespace AttrValue {\n /** Properties of a ListValue. *\n export declare interface IListValue {\n /** ListValue s *\n s?: (string[]|null);\n /** ListValue i *\n i?: ((number | string)[]|null);\n /** ListValue f *\n f?: (number[]|null);\n /** ListValue b *\n b?: (boolean[]|null);\n /** ListValue type *\n type?: (DataType[]|null);\n /** ListValue shape *\n shape?: (ITensorShape[]|null);\n /** ListValue tensor *\n tensor?: (ITensor[]|null);\n /** ListValue func *\n func?: (INameAttrList[]|null);\n }\n}\n\n/** Properties of a NameAttrList. *\n\nexport declare interface INameAttrList {\n /** NameAttrList name *\n name?: (string|null);\n /** NameAttrList attr *\n attr?: ({[k: string]: IAttrValue}|null);\n}\n\n/** Properties of a NodeDef. *\n\nexport declare interface INodeDef {\n /** NodeDef name *\n name?: (string|null);\n /** NodeDef op *\n op?: (string|null);\n /** NodeDef input *\n input?: (string[]|null);\n /** NodeDef device *\n device?: (string|null);\n /** NodeDef attr *\n attr?: ({[k: string]: IAttrValue}|null);\n}\n\n/** Properties of a VersionDef. *\n\nexport declare interface IVersionDef {\n /** VersionDef producer *\n producer?: (number|null);\n /** VersionDef minConsumer *\n minConsumer?: (number|null);\n /** VersionDef badConsumers *\n badConsumers?: (number[]|null);\n}\n\n/** Properties of a GraphDef. *\n\nexport declare interface IGraphDef {\n
```

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/** GraphDef node */\n node?: (INodeDef[]|null);\n\n /** GraphDef versions */\n versions?:
(IVersionDef|null);\n\n /** GraphDef library */\n library?: (IFunctionDefLibrary|null);\n\n\n /** Properties of a
CollectionDef. */\n\nexport declare interface ICollectionDef {\n /** CollectionDef nodeList */\n nodeList?:
(CollectionDef.INodeList|null);\n\n /** CollectionDef bytesList */\n bytesList?:
(CollectionDef.IBytesList|null);\n\n /** CollectionDef
int64List */\n int64List?: (CollectionDef.IInt64List|null);\n\n /** CollectionDef floatList */\n floatList?:
(CollectionDef.IFloatList|null);\n\n /** CollectionDef anyList */\n anyList?:
(CollectionDef.IAnyList|null);\n\n\n\nexport namespace CollectionDef {\n /** Properties of a NodeList. */\n export
declare interface INodeList {\n /** NodeList value */\n value?: (string[]|null);\n }\n\n /** Properties of a
BytesList. */\n export declare interface IBytesList {\n /** BytesList value */\n value?: (Uint8Array[]|null);\n
}\n\n /** Properties of an Int64List. */\n export declare interface IInt64List {\n /** Int64List value */\n value?:
((number | string)|null);\n }\n\n /** Properties of a FloatList. */\n export declare interface IFloatList {\n /**
FloatList value */\n value?: (number[]|null);\n }\n\n /** Properties of an AnyList. */\n export declare interface
IAnyList {\n /** AnyList value */\n value?: (IAny[]|null);\n }\n}\n\n\n /** Properties
of a SaverDef. */\n\nexport declare interface ISaverDef {\n /** SaverDef filenameTensorName */\n filenameTensorName?:
(string|null);\n\n /** SaverDef saveTensorName */\n saveTensorName?: (string|null);\n\n\n /** SaverDef restoreOpName
*/\n restoreOpName?: (string|null);\n\n /** SaverDef maxToKeep */\n maxToKeep?: (number|null);\n\n\n /** SaverDef
sharded */\n sharded?: (boolean|null);\n\n /** SaverDef
keepCheckpointEveryNHours */\n keepCheckpointEveryNHours?: (number|null);\n\n\n /** SaverDef version */\n version?:
(SaverDef.CheckpointFormatVersion|null);\n}\n\n\nexport namespace SaverDef {\n /**
CheckpointFormatVersion enum. */\n export enum CheckpointFormatVersion {'LEGACY' = 0, 'V1' = 1, 'V2' =
2}\n}\n\n\n /** Properties of a TensorInfo. */\n\nexport declare interface ITensorInfo {\n /** TensorInfo name */\n
name?: (string|null);\n\n /** TensorInfo cooSparse */\n cooSparse?: (TensorInfo.ICooSparse|null);\n\n /**
TensorInfo dtype */\n dtype?: (DataType|null);\n\n\n /**
TensorInfo tensorShape */\n tensorShape?: (ITensorShape|null);\n}\n\n\nexport namespace TensorInfo {\n /**
Properties of a CooSparse. */\n export declare interface ICooSparse {\n /** CooSparse valuesTensorName */\n
valuesTensorName?: (string|null);\n\n /** CooSparse indicesTensorName */\n indicesTensorName?:
(string|null);\n\n /** CooSparse denseShapeTensorName */\n denseShapeTensorName?: (string|null);\n
}\n}\n\n\n /** Properties of a SignatureDef. */\n\nexport declare interface ISignatureDef {\n /** SignatureDef inputs
*/\n inputs?: ({[k: string]: ITensorInfo}|null);\n\n /** SignatureDef outputs */\n outputs?: ({[k: string]:
ITensorInfo}|null);\n\n /** SignatureDef methodName */\n methodName?: (string|null);\n}\n\n\n /** Properties of an
AssetFileDef. */\n\nexport declare interface IAssetFileDef {\n /** AssetFileDef tensorInfo */\n tensorInfo?:
(ITensorInfo|null);\n\n /** AssetFileDef filename */\n filename?: (string|null);\n}\n\n\n /** Properties of an OpDef.
*/\n\nexport
declare interface IOpDef {\n /** OpDef name */\n name?: (string|null);\n\n /** OpDef inputArg */\n inputArg?:
(OpDef.IArgDef[]|null);\n\n /** OpDef outputArg */\n outputArg?: (OpDef.IArgDef[]|null);\n\n /** OpDef attr
*/\n attr?: (OpDef.IAttrDef[]|null);\n\n /** OpDef deprecation */\n deprecation?:
(OpDef.IOpDeprecation|null);\n\n /** OpDef summary */\n summary?: (string|null);\n\n /** OpDef description
*/\n description?: (string|null);\n\n /** OpDef isCommutative */\n isCommutative?: (boolean|null);\n\n /** OpDef
isAggregate */\n isAggregate?: (boolean|null);\n\n /** OpDef isStateful */\n isStateful?: (boolean|null);\n\n\n /**
OpDef allowsUninitializedInput */\n allowsUninitializedInput?: (boolean|null);\n}\n\n\nexport namespace OpDef {\n
/** Properties of an ArgDef. */\n export declare interface IArgDef {\n /** ArgDef name */\n name?:
(string|null);\n\n /** ArgDef description */\n description?: (string|null);\n\n /** ArgDef type */\n type?:
(DataType|null);\n\n /** ArgDef typeAttr */\n typeAttr?: (string|null);\n\n /** ArgDef numberAttr */\n
numberAttr?: (string|null);\n\n /** ArgDef typeListAttr */\n typeListAttr?: (string|null);\n\n /** ArgDef isRef
*/\n isRef?: (boolean|null);\n }\n\n\n /** Properties of an AttrDef. */\n export declare interface IAttrDef {\n /**
AttrDef name */\n name?: (string|null);\n\n /** AttrDef type */\n type?: (string|null);\n\n /** AttrDef
defaultValue */\n defaultValue?: (IAttrValue|null);\n\n /** AttrDef description */\n description?:

```

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(string|null);
\n /** AttrDef hasMinimum */
\n hasMinimum?: (boolean|null);
\n /** AttrDef minimum */
\n minimum?: (number|string|null);
\n /** AttrDef allowedValues */
\n allowedValues?: (IAttrValue|null);
\n }
\n /** Properties of an OpDeprecation. */
\n export declare interface IOpDeprecation {
\n /** OpDeprecation version */
\n version?: (number|null);
\n /** OpDeprecation explanation */
\n explanation?: (string|null);
\n }
\n /** Properties of an OpList. */
\n export declare interface IOpList {
\n /** OpList op */
\n op?: (IOpDef[]|null);
\n }
\n /** Properties of a MetaGraphDef. */
\n export declare interface IMetaGraphDef {
\n /** MetaGraphDef metaInfoDef */
\n metaInfoDef?: (MetaGraphDef.IMetaInfoDef|null);
\n /** MetaGraphDef graphDef */
\n graphDef?: (IGraphDef|null);
\n /** MetaGraphDef saverDef */
\n saverDef?: (ISaverDef|null);
\n /** MetaGraphDef collectionDef */
\n collectionDef?: ({[k: string]: ICollectionDef}|null);
\n /** MetaGraphDef signatureDef */
\n signatureDef?: ({[k: string]: ISignatureDef}|null);
\n /** MetaGraphDef assetFileDef */
\n assetFileDef?: (IAssetFileDef[]|null);
\n }
\n export namespace MetaGraphDef {
\n /** Properties of a MetaInfoDef. */
\n export declare interface IMetaInfoDef {
\n /** MetaInfoDef metaGraphVersion */
\n metaGraphVersion?: (string|null);
\n /** MetaInfoDef strippedOpList */
\n strippedOpList?: (IOpList|null);
\n /** MetaInfoDef anyInfo */
\n anyInfo?: (IAny|null);
\n /** MetaInfoDef tags */
\n tags?: (string[]|null);
\n /** MetaInfoDef tensorflowVersion */
\n tensorflowVersion?: (string|null);
\n /** MetaInfoDef tensorflowGitVersion */
\n tensorflowGitVersion?: (string|null);
\n }
\n /** Properties of a SavedModel. */
\n export declare interface ISavedModel {
\n /** SavedModel savedModelSchemaVersion */
\n savedModelSchemaVersion?: (number|string|null);
\n /** SavedModel metaGraphs */
\n metaGraphs?: (IMetaGraphDef[]|null);
\n }
\n /** Properties of a FunctionDefLibrary. */
\n export declare interface IFunctionDefLibrary {
\n /** FunctionDefLibrary function */
\n 'function': (IFunctionDef[]|null);
\n /** FunctionDefLibrary gradient */
\n gradient?: (IGradientDef[]|null);
\n }
\n /** Properties of a FunctionDef. */
\n export declare interface IFunctionDef {
\n /** FunctionDef signature */
\n signature?: (IOpDef|null);
\n /** FunctionDef attr */
\n attr?: ({[k: string]: IAttrValue}|null);
\n /** FunctionDef nodeDef */
\n nodeDef?: (INodeDef[]|null);
\n /** FunctionDef ret */
\n ret?: ({[k: string]: string}|null);
\n }
\n /** Properties of a GradientDef. */
\n export declare interface IGradientDef {
\n /** GradientDef functionName */
\n functionName?: (string|null);
\n /** GradientDef gradientFunc */
\n gradientFunc?: (string|null);
\n }
\n "
\n /**
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\n * limitations under the License.
\n */
\n
\n =====
\n
\n import {OpExecutor, OpMapper} from './types';
\n const CUSTOM_OPS: {[key: string]: OpMapper} = {};
\n /**
\n * Register an Op for graph model executor. This allow you to register
\n * TensorFlow custom op or override existing op.
\n * Here is an example of registering a new MatMul Op.
\n * ```js
\n * const customMatmul = (node) =>{
\n * tf.matMul(node.inputs[0], node.inputs[1], node.attrs['transpose_a'],
\n * node.attrs['transpose_b']);
\n * tf.registerOp('MatMul', customMatmul);
\n * ```
\n * The inputs and attrs of the node object is based on the TensorFlow op
\n * registry.
\n * @param name The Tensorflow Op name.
\n * @param opFunc An op function which is called with the current graph node
\n * during execution and needs to return a tensor or a list of tensors. The node
\n * has the following attributes:
\n * - attr: A map from attribute name to its value
\n * - inputs: A list of input tensors
\n * @doc {heading: 'Models', subheading: 'Op Registry'}
\n */
\n export function registerOp(name: string, opFunc: OpExecutor) {
\n const opMapper: OpMapper = {
\n tfOpName: name,
\n category: 'custom',
\n inputs: [],
\n attrs: [],
\n customExecutor: opFunc
\n };
\n CUSTOM_OPS[name] = opMapper;
\n }
\n /**
\n * Retrieve the OpMapper object for the registered op.
\n * @param name The Tensorflow Op name.
\n * @doc {heading: 'Models', subheading: 'Op Registry'}
\n */
\n export

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function getRegisteredOp(name: string): OpMapper {
 return CUSTOM_OPS[name];
}

// Deregister the Op for graph model executor.
// @param name The Tensorflow Op name.
// @doc {heading: 'Models', subheading: 'Op Registry'}
export function deregisterOp(name: string) {
 delete CUSTOM_OPS[name];
}

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=====

import {clone, Tensor, util} from '@tensorflow/tfjs-core';
import {NamedTensorsMap} from '../data/types';
import {ExecutionContext} from '../executor/execution_context';
import {ResourceManager} from '../executor/resource_manager';
import {Node, ValueType} from './types';

export function getParamValue(
 paramName: string, node: Node, tensorMap: NamedTensorsMap,
 context: ExecutionContext, resourceManager?: ResourceManager):
 ValueType {
 const inputParam = node.inputParams[paramName];
 if (inputParam && inputParam.inputIndexStart !== undefined) {
 const start = inputParam.inputIndexStart;
 const end = inputParam.inputIndexEnd === 0 ?
 undefined : (inputParam.inputIndexEnd === undefined ?
 start + 1 : inputParam.inputIndexEnd);
 if (inputParam.type === 'tensor') {
 return getTensor(
 node.inputNames[inputParam.inputIndexStart], tensorMap, context,
 resourceManager);
 }
 if (inputParam.type === 'tensors') {
 const inputs = node.inputNames.slice(start, end);
 return inputs.map(
 name => getTensor(name, tensorMap, context, resourceManager));
 }
 const tensor = getTensor(
 node.inputNames.slice(start)[0], tensorMap, context, resourceManager);
 const data = tensor.dataSync();
 return inputParam.type === 'number' ?
 data[0] : util.toNestedArray(tensor.shape, data);
 }
 const attrParam = node.attrParams[paramName];
 return attrParam && attrParam.value;
}

// Retrieve the tensor from tensorsMap based on input name.
// @param name Node input name
// @param tensorsMap Tensors map keyed by the node
// @param context contains tensors and information for running the current node.
// @param resourceManager Optional. Contains global resources of the model.
export function getTensor(
 name: string, tensorsMap: NamedTensorsMap, context: ExecutionContext,
 resourceManager?: ResourceManager): Tensor {
 const [nodeName, index] = parseNodeName(name);
 if (resourceManager != null) {
 const tensor = resourceManager.getHashTableHandleByName(nodeName);
 if (tensor != null) {
 return tensor;
 }
 }
 const contextId = context.currentContextIds.find(
 contextId => {
 return !!tensorsMap[getNodeNameWithContextId(
 nodeName, contextId)];
 });
 return contextId !== undefined ?
 tensorsMap[getNodeNameWithContextId(
 nodeName, contextId)][index] :
 undefined;
}

// Retrieve the tensors based on input name for current context.
// @param name Node input name
// @param tensorsMap Tensors map keyed by the node
export function getTensorsForCurrentContext(
 name: string, tensorsMap: NamedTensorsMap, context: ExecutionContext):
 Tensor[] {
 return tensorsMap[getNodeNameWithContextId(
 name, context.currentContextId)];
}

// Returns the node name and index from the Node input name.
// @param inputName The input name of the node, in format of
// node_name:output_index, i.e. MatMul:0, if the output_index is not set,
// it is default to 0.
export function getNodeNameAndIndex(
 inputName: string, context?: ExecutionContext): [string, number] {
 const [nodeName, index] = parseNodeName(inputName);
 return [
 getNodeNameWithContextId(nodeName, context &&
 context.currentContextId), index];
}

function getNodeNameWithContextId(name: string, contextId?: string):
 string {
 return `!contextId ? ${name}-${contextId}` : name;
}

export function parseNodeName(name: string): [string, number] {
 const parts = name.split(':');
 if (parts.length === 1) {

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return [name, 0];\n }
\n\n const nodeName = parts[0];\n return [nodeName, Number(parts[parts.length -
1])];\n}\n\nexport function split(arr: number[], size: number) {\n const res = [];\n for (let i = 0; i < arr.length; i +=
size) {\n res.push(arr.slice(i, i + size));\n }\n return res;\n}\n\nexport function getPadding(\n node: Node,\n tensorMap: NamedTensorsMap,\n context: ExecutionContext): ValueType {\n let pad = getParamValue('pad',\n node, tensorMap, context);\n if (pad === 'explicit') {\n // This is 1d array, we need to convert it to 2d array\n pad = getParamValue('explicitPaddings', node, tensorMap, context);\n const explicitPadding: [\n
[number, number], [number, number], [number, number], [number, number]\n] = [[0, 0], [0, 0], [0, 0], [0, 0]];\n for (let i = 0; i < 4; i++) {\n explicitPadding[i][0] = (pad as number[])[i * 2];\n explicitPadding[i][1] = (pad as
number[])[i * 2 + 1];\n }\n return explicitPadding;\n }\n return pad;\n}\n\n/**\n * Reuse the tensor if it is
marked as keep, otherwise clone the tensor to\n * avoid disposal. This is important for TensorArray and TensorList
ops, since\n * internally they use a tensor as the id for TensorArray and TensorList, and\n * to simplify lookup, they
also use Tensor.id as the key to the internal map.\n * These id tensors have been marked as kept in the backend, we
need avoid clone\n * them in order to create new Tensor.id.\n * @param tensor\n */\nexport function
cloneTensor(tensor: Tensor): Tensor {\n return tensor.kept ? tensor : clone(tensor);\n}\n\n"/**\n * @license\n *
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */

```

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*/\n\nimport { OpMapper } from './types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Add',\n
'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type':
'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n
'tfOpName': 'AddV2',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type':
'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type':
'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'AddN',\n 'category': 'arithmetic',\n 'inputs': [{\n 'start':
0, 'end': 0, 'name': 'tensors', 'type': 'tensors'}\n]\n },\n {\n 'tfOpName': 'BiasAdd',\n 'category': 'arithmetic',\n
'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n
{'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true},\n {'tfName': 'data_format',\n 'name':
'dataFormat',\n 'type': 'string',\n 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Sub',\n
'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type':
'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type':
'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'RealDiv',\n 'category': 'arithmetic',\n 'inputs': [\n
{'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T',
'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Div',\n 'category': 'arithmetic',\n
'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n
{'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'DivNoNan',\n
'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type':
'tensor'},\n],\n 'attrs': [\n {'tfName':\n 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'FloorDiv',\n
'category':\n 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n
],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName':
'Mul',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b',
'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n
{\n 'tfOpName': 'Maximum',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n
{'start': 1, 'name': 'b', 'type': 'tensor'}\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype',

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'notSupported': true}\n]\n },\n {\n 'tfOpName':
'Minimum',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1,
'name': 'b', 'type': 'tensor'}\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n
]\n },\n {\n 'tfOpName': 'Pow',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type':
'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type':
'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'SquaredDifference',\n 'category': 'arithmetic',\n
'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n
{'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Mod',\n
'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type':
'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type':
'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'FloorMod',\n 'category': 'arithmetic',\n 'inputs': [\n
{'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName':
'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }]\n }\n];\n\n",\n "import {OpMapper} from
'./types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Abs',\n 'category': 'basic_math',\n 'inputs': [\n
{'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype',
'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Acos',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0,
'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n
]\n },\n {\n 'tfOpName': 'Asin',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type':
'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Atan',\n 'category': 'basic_math',\n 'inputs': [\n
{'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype',
'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Atan2',\n 'category': 'basic_math',\n 'inputs': [\n {'start':
0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'y', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name':
'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Ceil',\n 'category': 'basic_math',\n
'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type':
'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'ClipByValue',\n 'category': 'basic_math',\n 'inputs':
[\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name':
'clipValueMin', 'type': 'number'},\n {'start': 2, 'name': 'clipValueMax', 'type': 'number'},\n],\n 'attrs': [\n
{'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Complex',\n
'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'real', 'type': 'tensor'},\n {'start': 1, 'name': 'imag',
'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n
{\n 'tfOpName': 'ComplexAbs',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the
License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
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'name': 'dilations', 'type': 'number[]'},\n {'tfName': 'padding', 'name': 'pad', 'type': 'string'}\n]\n }\n }]\n }"},\n"import
{OpMapper} from './types';\n\n**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Fill',\n 'category': 'creation',\n 'inputs': [\n
{'start': 0, 'name': 'shape', 'type': 'number[]'},\n {'start': 1, 'name': 'value', 'type': 'number'},\n],\n 'attrs':
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{'start': 0, 'name': 'start', 'type':
'number'},\n {'start': 1, 'name': 'stop', 'type': 'number'},\n {'start': 2, 'name': 'num', 'type': 'number'},\n],\n 'attrs': [\n
{'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName':
'OneHot',\n 'category': 'creation',\n 'inputs': [\n {'start': 0, 'name': 'indices', 'type': 'tensor'},\n {'start': 1,
'name': 'depth', 'type': 'number'},\n {'start': 2, 'name': 'onValue', 'type': 'number', 'defaultValue': 1},\n {'start': 3,
'name': 'offValue', 'type': 'number', 'defaultValue': 0},\n],\n 'attrs': [\n {\n 'tfName': 'axis',\n 'name':
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'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Ones',\n 'category': 'creation',\n 'inputs': [\n
{'start': 0, 'name': 'shape', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'T', 'name': 'dtype', 'type':
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'type': 'tensor'},\n],\n 'attrs': [{'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'}]\n },\n {\n 'tfOpName':
'RandomUniform',\n 'category': 'creation',\n 'inputs': [\n {'start': 0, 'name': 'shape', 'type': 'number[]'},\n],\n 'attrs': [\n
{\n 'tfName': 'minval',\n 'name': 'minval',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n
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'number', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Range',\n 'category': 'creation',\n 'inputs': [\n
{'start': 0, 'name': 'start', 'type': 'number'},\n {'start': 1, 'name': 'stop', 'type': 'number'},\n {'start': 2, 'name':
'step', 'type': 'number', 'defaultValue': 0},\n],\n 'attrs': [{'tfName': 'Tidx', 'name': 'dtype', 'type': 'dtype'}]\n },\n {\n 'tfOpName': 'TruncatedNormal',\n 'category': 'creation',\n 'inputs': [\n
{'start': 0, 'name': 'shape', 'type':
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*
\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'TopKV2',\n 'category': 'evaluation',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'},\n {\n 'start': 1,\n 'name': 'k',\n 'type': 'number'},\n],\n 'attrs': [{\n 'tfName':\n 'sorted',\n 'name': 'sorted',\n 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Unique',\n 'category': 'evaluation',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'},\n],\n },\n {\n 'tfOpName': 'UniqueV2',\n 'category': 'evaluation',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'},\n {\n 'start': 1,\n 'name': 'axis',\n 'type':\n 'number'},\n],\n },\n];\n\nimport {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'PlaceholderWithDefault',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'default',\n 'type': 'tensor'},\n],\n 'attrs':\n [\n {\n 'tfName': 'shape',\n 'name': 'shape',\n 'type': 'shape'},\n {\n 'tfName': 'dtype',\n 'name': 'dtype',\n 'type': 'dtype'}]\n },\n {\n 'tfOpName': 'Placeholder',\n 'category': 'graph',\n 'attrs': [\n {\n 'tfName': 'shape',\n 'name': 'shape',\n 'type': 'shape'},\n {\n 'tfName': 'dtype',\n 'name': 'dtype',\n 'type': 'dtype'}]\n },\n {\n 'tfOpName': 'Const',\n 'category':\n 'graph',\n {\n 'tfOpName': 'Identity',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'IdentityN',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'end': 0,\n 'name': 'x',\n 'type': 'tensors'}]\n },\n {\n 'tfOpName': 'Snapshot',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'Rank',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'Size',\n 'category': 'graph',\n 'inputs': [\n {\n 'start':\n 0,\n 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'Shape',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'ShapeN',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'end': 0,\n 'name': 'x',\n 'type': 'tensors'}]\n },\n {\n 'tfOpName': 'Print',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'},\n {\n 'start': 1,\n 'name': 'data',\n 'type': 'tensors'},\n],\n 'attrs': [\n {\n 'tfName': 'message',\n 'name': 'message',\n 'type': 'string'},\n {\n 'tfName': 'first_n',\n 'name': 'firstN',\n 'type': 'number',\n 'notSupported': true\n },\n {\n 'tfName': 'summarize',\n 'name': 'summarize',\n 'type': 'number',\n 'defaultValue': 3\n }]\n },\n {\n 'tfOpName': 'NoOp',\n 'category': 'graph',\n 'inputs': []\n },\n {\n 'tfOpName':\n 'StopGradient',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'FakeQuantWithMinMaxVars',\n 'category': 'graph',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'min',\n 'name': 'min',\n 'type':\n 'number'},\n {\n 'tfName': 'max',\n 'name': 'max',\n 'type': 'number'}]\n }]\n];\n\nimport {OpMapper} from './types';\n\n/**\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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*
\n\nimport {OpMapper} from './types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'HashTable',\n 'category': 'hash_table',\n 'inputs': [],\n 'attrs': [\n {\n 'tfName': 'shared_name',\n 'name': 'sharedName',\n 'type':\n 'string'},\n {\n 'tfName': 'use_node_name_sharing',\n 'name': 'useNodeNameSharing',\n 'type':\n 'bool'}]\n },\n {\n 'tfName': 'key_dtype',\n 'name': 'keyDType',\n 'type': 'dtype'},\n {\n 'tfName': 'value_dtype',\n 'name':\n 'valueDType',\n 'type': 'dtype'},\n]\n},\n {\n 'tfOpName': 'HashTableV2',\n 'category': 'hash_table',\n 'inputs':
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*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Equal',\n 'category': 'logical',\n 'inputs': [\n
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]\n },\n {\n 'tfOpName': 'Less',\n 'category': 'logical',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n
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{'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'LogicalNot',\n
'category': 'logical',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name':
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'logical',\n 'inputs': [\n {'start': 0, 'name': 'condition', 'type': 'tensor'},\n {'start': 1, 'name': 'a', 'type': 'tensor'},\n
{'start': 2, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported':
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'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n }]\n];\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport {OpMapper} from '../types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName':
'_FusedMatMul',\n 'category': 'matrices',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1,
'name': 'b', 'type': 'tensor'},\n {'start': 2, 'end': 0, 'name': 'args', 'type': 'tensors'},\n],\n 'attrs': [\n {'tfName':
'num_args', 'name': 'numArgs', 'type': 'number'},\n {'tfName': 'fused_ops', 'name': 'fusedOps', 'type':
'string[]', 'defaultValue': []\n },\n {'tfName': 'epsilon', 'name': 'epsilon', 'type':
'number', 'defaultValue': 0.0001}\n
},\n {\n 'tfName': 'transpose_a', 'name': 'transposeA', 'type': 'bool', 'defaultValue':
false\n },\n {\n 'tfName': 'transpose_b', 'name': 'transposeB', 'type': 'bool', 'defaultValue':
false\n },\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'MatMul',\n
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'type': 'bool',\n 'defaultValue': false\n },\n {\n 'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported':\n true\n }\n],\n {\n 'tfOpName': 'BatchMatMul',\n 'category': 'matrices',\n 'inputs': [\n {\n 'start': 0, 'name': 'a', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'b', 'type':\n 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'adj_x',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n {\n 'tfName': 'adj_y',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n {\n 'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'BatchMatMulV2',\n 'category': 'matrices',\n 'inputs': [\n {\n 'start': 0, 'name': 'a', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'adj_x',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n {\n 'tfName': 'adj_y',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n {\n 'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'Transpose',\n 'category': 'matrices',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'perm',\n 'type': 'number[]'\n }\n],\n 'attrs': [\n {\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }\n]\n },\n "import {OpMapper} from '../types';\n **\n * @license\n * Copyright 2018\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
 *
 * =====\n *
 * export const json: OpMapper[] = [\n {\n 'tfOpName': 'FusedBatchNorm',\n 'category': 'normalization',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'scale', 'type': 'tensor'},\n {\n 'start': 2, 'name': 'offset', 'type': 'tensor'},\n {\n 'start': 3, 'name': 'mean', 'type': 'tensor'},\n {\n 'start': 4, 'name': 'variance',\n 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'epsilon',\n 'name': 'epsilon',\n 'type': 'number',\n 'defaultValue': 0.001\n },\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'FusedBatchNormV2',\n 'category': 'normalization',\n 'inputs':\n [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'scale', 'type': 'tensor'},\n {\n 'start': 2, 'name':\n 'offset', 'type': 'tensor'},\n {\n 'start': 3, 'name': 'mean', 'type': 'tensor'},\n {\n 'start': 4, 'name': 'variance', 'type':\n 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'epsilon',\n 'name': 'epsilon',\n 'type': 'number',\n 'defaultValue': 0.001\n },\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'FusedBatchNormV3',\n 'category': 'normalization',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'scale', 'type': 'tensor'},\n {\n 'start': 2, 'name': 'offset', 'type': 'tensor'},\n {\n 'start': 3, 'name': 'mean', 'type': 'tensor'},\n {\n 'start': 4, 'name': 'variance',\n 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'epsilon',\n 'name': 'epsilon',\n 'type': 'number',\n 'defaultValue': 0.001\n },\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'LRN',\n 'category': 'normalization',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type':\n 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'depth_radius',\n 'name': 'radius',\n 'type': 'number',\n 'defaultValue': 5\n },\n {\n 'tfName': 'bias',\n 'name': 'bias',\n 'type': 'number',\n 'defaultValue': 1.0\n },\n {\n 'tfName': 'alpha',\n 'name': 'alpha',\n 'type': 'number',\n 'defaultValue': 1.0\n },\n {\n 'tfName': 'beta',\n 'name': 'beta',\n 'type': 'number',\n 'defaultValue': 0.5\n }\n]\n },\n {\n 'tfOpName': 'Softmax',\n 'category': 'normalization',\n 'inputs':\n [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'LogSoftmax',\n 'category': 'normalization',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'SparseToDense',\n 'category':\n 'normalization',\n 'inputs': [\n {\n 'start': 0, 'name': 'sparseIndices',\n 'type': 'tensor'},\n {\n 'start': 1, 'name':\n 'outputShape', 'type': 'number[]'},\n {\n 'start': 2, 'name': 'sparseValues',\n 'type': 'tensor'},\n {\n 'start': 3, 'name':

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'defaultValue', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name': 'validateIndices',\n 'type': 'bool',\n 'defaultValue': true,\n 'notSupported': true\n }]\n }],\n";\n", "import {OpMapper} from\n './types';\n\n**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain\n a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by\n applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Bincount',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'size', 'type': 'number'},\n {'start': 2, 'name': 'weights',\n 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'DenseBincount',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'size', 'type': 'number'},\n {'start':\n 2, 'name': 'weights', 'type': 'tensor'}\n],\n 'attrs':\n [{\n 'tfName': 'binary_output',\n 'name': 'binaryOutput',\n 'type':\n 'bool'}\n]\n },\n {\n 'tfOpName': 'Max',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':\n 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName': 'keep_dims',\n 'name':\n 'keepDims',\n 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'Mean',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0,\n 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName': 'keep_dims',\n 'name': 'keepDims',\n 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'Min',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName':\n 'keep_dims',\n 'name': 'keepDims',\n 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'Sum',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type':\n 'number[]'},\n],\n 'attrs': [{\n 'tfName': 'keep_dims',\n 'name': 'keepDims',\n 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'All',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis',\n 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName': 'keep_dims',\n 'name': 'keepDims',\n 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'Any',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1,\n 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName': 'keep_dims',\n 'name': 'keepDims',\n 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'ArgMax',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}\n]\n },\n {\n 'tfOpName': 'ArgMin',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}\n]\n },\n {\n 'tfOpName': 'Prod',\n 'category': 'reduction',\n 'inputs':\n [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs':\n [{\n 'tfName': 'keep_dims',\n 'name': 'keepDims',\n 'type': 'bool'}\n]\n },\n {\n 'tfOpName': 'Cumsum',\n 'category':\n 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'},\n],\n 'attrs': [\n {\n 'tfName': 'exclusive',\n 'name': 'exclusive',\n 'type': 'bool'},\n {\n 'tfName': 'reverse',\n 'name': 'reverse',\n 'type': 'bool'}\n]\n }\n];\n", "import {OpMapper} from './types';\n\n**\n * @license\n * Copyright 2018 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an \"AS IS\"\n BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'ConcatV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'end': -1, 'name': 'tensors', 'type': 'tensors'},\n {'start': -1, 'name': 'axis', 'type': 'number'}\n]\n },\n {\n 'attrs':\n [\n {\n 'tfName': 'N',\n 'name': 'n',\n 'type': 'number',\n 'defaultValue': 2}\n]\n },\n {\n 'tfOpName': 'Concat',\n 'category': 'slice_join',\n
```

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'inputs': [\n {'start': 1, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n {'start': 0, 'name': 'axis', 'type':
'number'}\n],\n 'attrs': [{'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2}]\n\n },\n {\n 'tfOpName':
'GatherV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name':
'indices', 'type': 'tensor'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n],\n 'attrs': [{\n
'tfName': 'batch_dims',\n 'name': 'batchDims',\n 'type': 'number',\n 'defaultValue': 0\n }]\n },\n {\n
'tfOpName': 'Gather',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start':
1, 'name': 'indices', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name':
'validateIndices',\n 'type': 'bool',\n 'notSupported': true\n
}]\n },\n {\n 'tfOpName': 'Reverse',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n {'start': 1, 'name': 'dims', 'type': 'bool[]'}\n]\n },\n {\n 'tfOpName': 'ReverseV2',\n 'category':
'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'}\n
]\n },\n {\n 'tfOpName': 'Slice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n {'start': 1, 'name': 'begin', 'type': 'number[]'},\n {'start': 2, 'name': 'size', 'type': 'number[]'}\n
]\n },\n {\n 'tfOpName': 'StridedSlice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':
'tensor'},\n {'start': 1, 'name': 'begin', 'type': 'number[]'},\n {'start': 2, 'name': 'end', 'type': 'number[]'},\n
{'start': 3, 'name': 'strides', 'type': 'number[]'},\n],\n 'attrs':
[\n {\n 'tfName': 'begin_mask',\n 'name': 'beginMask',\n 'type': 'number',\n 'defaultValue': 0\n
},\n {\n 'tfName': 'end_mask',\n 'name': 'endMask',\n 'type': 'number',\n 'defaultValue': 0\n
},\n {\n 'tfName': 'new_axis_mask',\n 'name': 'newAxisMask',\n 'type': 'number',\n
'defaultValue': 0\n },\n {\n 'tfName': 'ellipsis_mask',\n 'name': 'ellipsisMask',\n 'type': 'number',\n
'defaultValue': 0\n },\n {\n 'tfName': 'shrink_axis_mask',\n 'name': 'shrinkAxisMask',\n 'type':
'number',\n 'defaultValue': 0\n }]\n },\n {\n 'tfOpName': 'Pack',\n 'category': 'slice_join',\n 'inputs':
[\n {'start': 0, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n],\n 'attrs': [\n {'tfName': 'axis', 'name': 'axis',
'type': 'number', 'defaultValue': 0}\n]\n },\n {\n 'tfOpName':
'Unpack',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n],\n 'attrs': [\n
{'tfName': 'axis', 'name': 'axis', 'type': 'number', 'defaultValue': 0},\n {\n 'tfName': 'num',\n 'name': 'num',\n
'type': 'number',\n 'defaultValue': 0,\n 'notSupported': true\n }]\n },\n {\n 'tfOpName': 'Tile',\n
'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'reps', 'type':
'number[]'}\n]\n },\n {\n 'tfOpName': 'Split',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name':
'axis', 'type': 'number', 'defaultValue': 0},\n {'start': 1, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [{\n
'tfName': 'num_split',\n 'name': 'numOrSizeSplits',\n 'type': 'number',\n 'defaultValue': 1\n }]\n },\n {\n
'tfOpName': 'SplitV',\n 'category': 'slice_join',\n
'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'numOrSizeSplits', 'type':
'number[]'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n]\n },\n {\n 'tfOpName':
'ScatterNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'indices', 'type': 'tensor'},\n {'start': 1,
'name': 'values', 'type': 'tensor'},\n {'start': 2, 'name': 'shape', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName':
'GatherNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name':
'indices', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'SparseToDense',\n 'category': 'slice_join',\n 'inputs': [\n
{'start': 0, 'name': 'sparseIndices', 'type': 'tensor'},\n {'start': 1, 'name': 'outputShape', 'type': 'number[]'},\n
{'start': 2, 'name': 'sparseValues', 'type': 'tensor'},\n {'start': 3, 'name':
'defaultValue', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name': 'validateIndices',\n
'type': 'bool',\n 'defaultValue': false,\n 'notSupported': true\n }]\n }]\n }];\n\n","import {OpMapper} from
'./types';\n\n**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the

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*\n\nexport
const json: OpMapper[] = [\n {\n 'tfOpName': 'FFT',\n 'category': 'spectral',\n 'inputs': [{\n 'start': 0, 'name': 'x',
'type': 'tensor'}]\n },\n {\n 'tfOpName': 'IFFT',\n 'category': 'spectral',\n 'inputs': [{\n 'start': 0, 'name': 'x', 'type':
'tensor'}]\n },\n {\n 'tfOpName': 'RFFT',\n 'category': 'spectral',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type':
'tensor'}, {\n 'start': 1,\n 'name': 'fft_length',\n 'type': 'number',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'IRFFT',\n 'category': 'spectral',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'}, {\n
'start': 1,\n 'name': 'fft_length',\n 'type': 'number',\n 'notSupported': true\n }\n]\n
}]\n];\n", "import {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may
not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Cast',\n 'category': 'transformation',\n 'inputs': [\n
{\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'SrcT',\n 'name': 'sdtype',\n
'type': 'dtype',\n 'notSupported': true\n },\n {\n 'tfName': 'DstT',\n 'name': 'dtype',\n 'type': 'dtype'}\n]\n },\n
{\n 'tfOpName': 'ExpandDims',\n
'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'axis',
'type': 'number'}\n]\n },\n {\n 'tfOpName': 'MirrorPad',\n 'category': 'transformation',\n 'inputs': [\n
{\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'padding', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName':
'mode',\n 'name': 'mode',\n 'type': 'string'}]\n },\n {\n 'tfOpName': 'Pad',\n 'category': 'transformation',\n 'inputs':
[\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'padding', 'type': 'number[]'},\n],\n 'attrs': [{\n
'tfName': 'constant_value',\n 'name': 'constantValue',\n 'type': 'number',\n 'defaultValue': 0\n }]\n },\n {\n 'tfOpName': 'PadV2',\n
'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'padding',
'type': 'number[]'},\n {\n 'start': 2,\n 'name': 'constantValue',\n 'type': 'number',\n 'defaultValue': 0\n }\n]\n },\n {\n
'tfOpName': 'Reshape',\n 'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type':
'tensor'},\n {\n 'start': 1, 'name': 'shape', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'Squeeze',\n 'category':
'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'axis',\n
'tfDeprecatedName': 'squeeze_dims',\n 'name': 'axis',\n 'type': 'number[]'}]\n },\n {\n 'tfOpName':
'SpaceToBatchND',\n 'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n
{\n 'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {\n 'start': 2, 'name': 'paddings', 'type': 'number[]'}\n]\n },\n
{\n 'tfOpName': 'BatchToSpaceND',\n 'category': 'transformation',\n 'inputs':
[\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {\n 'start': 2,
'name': 'crops', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'DepthToSpace',\n 'category': 'transformation',\n
'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'block_size',\n 'name':
'blockSize',\n 'type': 'number'},\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string'}\n]\n },\n {\n
'tfOpName': 'BroadcastTo',\n 'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n
{\n 'start': 1, 'name': 'shape', 'type': 'number[]'},\n],\n 'attrs': []\n }]\n];\n", "*/\n\n * @license\n * Copyright 2018
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
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language governing permissions and\n \* limitations under the License.\n \*

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*\\n\\nimport {DataType, env} from '@tensorflow/tfjs-core';\\n\\nimport * as tensorflow from
'./data/compiled_api';\\n\\nimport {getRegisteredOp} from './custom_op/register';\\nimport {getNodeNameAndIndex}
from './executors/utils';\\nimport * as arithmetic from './op_list/arithmetic';\\nimport * as basicMath from
'./op_list/basic_math';\\nimport * as control from './op_list/control';\\nimport * as convolution from
'./op_list/convolution';\\nimport * as creation from './op_list/creation';\\nimport * as dynamic from
'./op_list/dynamic';\\nimport
* as evaluation from './op_list/evaluation';\\nimport * as graph from './op_list/graph';\\nimport * as hashTable from
'./op_list/hash_table';\\nimport * as image from './op_list/image';\\nimport * as logical from './op_list/logical';\\nimport
* as matrices from './op_list/matrices';\\nimport * as normalization from './op_list/normalization';\\nimport * as
reduction from './op_list/reduction';\\nimport * as sliceJoin from './op_list/slice_join';\\nimport * as spectral from
'./op_list/spectral';\\nimport * as transformation from './op_list/transformation';\\nimport {Graph, InputParamValue,
Node, OpMapper, ParamValue} from './types';\\n\\nexport class OperationMapper {\\n private static _instance:
OperationMapper;\\n\\n private opMappers: {[key: string]: OpMapper};\\n\\n // Singleton instance for the mapper\\n
public static get Instance() {\\n return this._instance || (this._instance = new this());\\n }\\n\\n // Loads the op
mapping from the JSON file.\\n private constructor() {\\n const ops
= [\\n arithmetic, basicMath, control, convolution, creation, dynamic,\\n evaluation, logical, image, graph,
matrices, normalization, reduction,\\n sliceJoin, spectral, transformation, hashTable\\n];\\n const mappersJson:
OpMapper[] = [].concat(...ops.map(op => op.json));\\n\\n this.opMappers = mappersJson.reduce<{[key: string]:
OpMapper}>(\\n (map, mapper: OpMapper) => {\\n map[mapper.tfOpName] = mapper;\\n return
map;\\n },\\n {});\\n }\\n\\n // Converts the model inference graph from TensorFlow GraphDef to local\\n //
representation for TensorFlow.js API\\n transformGraph(\\n graph: tensorflow.IGraphDef,\\n signature:
tensorflow.ISignatureDef = {}): Graph {\\n const tfNodes = graph.node;\\n const placeholders: Node[] = [];\\n
const weights: Node[] = [];\\n const initNodes: Node[] = [];\\n const nodes = tfNodes.reduce<{[key: string]:
Node}>(\\n (map, node) => {\\n map[node.name] = this.mapNode(node);\\n if (node.op.startsWith('Placeholder'))
{\\n placeholders.push(map[node.name]);\\n } else if (node.op === 'Const') {\\n
weights.push(map[node.name]);\\n } else if (node.input === null || node.input.length === 0) {\\n
initNodes.push(map[node.name]);\\n }\\n return map;\\n }, {});\\n let inputs: Node[] = [];\\n const outputs:
Node[] = [];\\n let inputNodeNameToKey: {[key: string]: string} = {};\\n let outputNodeNameToKey: {[key:
string]: string} = {};\\n if (signature !== null) {\\n inputNodeNameToKey =
this.mapSignatureEntries(signature.inputs);\\n outputNodeNameToKey =
this.mapSignatureEntries(signature.outputs);\\n }\\n const allNodes = Object.keys(nodes);\\n
allNodes.forEach(key => {\\n const node = nodes[key];\\n node.inputNames.forEach(name => {\\n const
[nodeName,] = getNodeNameAndIndex(name);\\n node.inputs.push(nodes[nodeName]);\\n
nodes[nodeName].children.push(node);\\n });\\n });\\n // if
signature has not outputs set, add any node that does not have\\n // outputs.\\n if
(Object.keys(outputNodeNameToKey).length === 0) {\\n allNodes.forEach(key => {\\n const node =
nodes[key];\\n if (node.children.length === 0) {\\n outputs.push(node);\\n }\\n });\\n } else {\\n
Object.keys(outputNodeNameToKey).forEach(name => {\\n const [nodeName,] =
getNodeNameAndIndex(name);\\n const node = nodes[nodeName];\\n if (node !== null) {\\n
node.signatureKey = outputNodeNameToKey[name];\\n outputs.push(node);\\n }\\n });\\n }\\n if
(Object.keys(inputNodeNameToKey).length > 0) {\\n Object.keys(inputNodeNameToKey).forEach(name => {\\n
const [nodeName,] = getNodeNameAndIndex(name);\\n const node = nodes[nodeName];\\n if (node) {\\n
node.signatureKey = inputNodeNameToKey[name];\\n inputs.push(node);\\n }\\n });\\n } else {\\n
inputs = placeholders;\\n
}\\n\\n let functions = {};\\n if (graph.library !== null && graph.library.function !== null) {\\n functions =
graph.library.function.reduce((functions, func) => {\\n functions[func.signature.name] =
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this.mapFunction(func);\n return functions;\n }, { } as {[key: string]: Graph});\n }\n\n const result: Graph\n =\n {nodes, inputs, outputs, weights, placeholders, signature, functions};\n\n if (initNodes.length > 0) {\n result.initNodes = initNodes;\n }\n\n return result;\n }\n\n private mapSignatureEntries(entries: {[k: string]:\n tensorflow.ITensorInfo}) {\n return Object.keys(entries || {})\n .reduce<{[key: string]: string}>((prev, curr)\n => {\n prev[entries[curr].name] = curr;\n return prev;\n }, {});\n }\n\n private mapNode(node:\n tensorflow.INodeDef): Node {\n // Unsupported ops will cause an error at run-time (not parse time), since\n // they may not be used by the actual execution subgraph.\n\n const mapper =\n getRegisteredOp(node.op) || this.opMappers[node.op] || {} as OpMapper;\n if (node.attr\n == null) {\n node.attr = {};\n }\n\n const newNode: Node = {\n name: node.name,\n op: node.op,\n category: mapper.category,\n inputNames:\n (node.input ||\n []).map(input => input.startsWith('^') ?\n input.substr(1) : input),\n inputs: [],\n children: [],\n inputParams: {},\n attrParams: {},\n rawAttrs:\n node.attr\n };\n\n if (mapper.inputs != null) {\n newNode.inputParams =\n mapper.inputs.reduce<{[key:\n string]: InputParamValue}>(\n (map, param) => {\n map[param.name] = {\n type:\n param.type,\n inputIndexStart: param.start,\n inputIndexEnd: param.end\n };\n return map;\n },\n {});\n }\n\n if (mapper.attrs != null) {\n newNode.attrParams\n =\n mapper.attrs.reduce<{[key: string]: ParamValue}>((map, param) => {\n const type = param.type;\n\n let value = undefined;\n switch (param.type) {\n case 'string':\n value =\n getStringParam(\n node.attr, param.tfName, param.defaultValue as string);\n if (value ===\n undefined && !!param.tfDeprecatedName) {\n value = getStringParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as string);\n }\n break;\n case 'string[]':\n value = getStringArrayParam(\n node.attr, param.tfName, param.defaultValue\n as string[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =\n getStringArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as\n string[]);\n }\n break;\n case 'number':\n value = getNumberParam(\n node.attr,\n param.tfName,\n (param.defaultValue || 0) as number);\n if (value === undefined &&\n !!param.tfDeprecatedName) {\n value = getNumberParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as number);\n }\n break;\n case 'number[]':\n value = getNumericArrayParam(\n node.attr, param.tfName,\n param.defaultValue as number[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value = getNumericArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[]);\n }\n break;\n case 'bool':\n value =\n getBoolParam(\n node.attr, param.tfName, param.defaultValue as boolean);\n if (value === undefined &&\n !!param.tfDeprecatedName) {\n value = getBoolParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as boolean);\n }\n break;\n case 'bool[]':\n value = getBoolArrayParam(\n node.attr, param.tfName, param.defaultValue as\n boolean[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =\n getBoolArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as\n boolean[]);\n }\n break;\n case 'shape':\n value = getTensorShapeParam(\n node.attr, param.tfName, param.defaultValue as number[]);\n if (value === undefined &&\n !!param.tfDeprecatedName) {\n value = getTensorShapeParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[]);\n }\n break;\n case 'shape[]':\n value =\n getTensorShapeArrayParam(\n node.attr, param.tfName, param.defaultValue as number[][]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value = getTensorShapeArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[][]);\n }\n break;\n case 'dtype':\n value = getDtypeParam(\n node.attr, param.tfName,

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param.defaultValue as DataType);\n if (value === undefined && !!param.tfDeprecatedName) {\n
value = getDtypeParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue\nas DataType);\n }\n break;\n case 'dtype[]':\n value = getDtypeArrayParam(\n node.attr, param.tfName, param.defaultValue as DataType[]);\n if (value === undefined &&\n!!param.tfDeprecatedName) {\n value = getDtypeArrayParam(\n node.attr,\nparam.tfDeprecatedName,\n param.defaultValue as DataType[]);\n }\n break;\n case 'func':\n value = getFuncParam(\n node.attr, param.tfName, param.defaultValue as\nstring);\n if (value === undefined && !!param.tfDeprecatedName) {\n value = getFuncParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as string);\n }\n break;\n case 'tensor':\n case 'tensors':\n break;\n default:\n throw new Error(\n `Unsupported param type: ${param.type} for op:\n${node.op}`);\n }\n map[param.name] = {value, type};\n return map;\n }, {});\n }\nreturn newNode;\n }\n\n // map the TFunctionDef to TFJS graph object\n private mapFunction(functionDef:\ntensorflow.IFunctionDef): Graph {\n const tfNodes = functionDef.nodeDef;\n const placeholders: Node[] = [];\n const weights: Node[] = [];\n let nodes: {[key: string]: Node} = {};\n if (tfNodes != null) {\n nodes =\ntfNodes.reduce<{[key: string]: Node}>((map, node) => {\n map[node.name] = this.mapNode(node);\n if\n(node.op === 'Const') {\n weights.push(map[node.name]);\n }\n return map;\n }, {});\n }\n const inputs: Node[] = [];\n const outputs: Node[] = [];\n functionDef.signature.inputArg.forEach(arg => {\n const [nodeName,] = getNodeNameAndIndex(arg.name);\n\n const node: Node = {\n name: nodeName,\n op: 'Placeholder',\n inputs: [],\n inputNames: [],\n category: 'graph',\n inputParams: {},\n attrParams: {dtype: {value: parseDtypeParam(arg.type), type:\n'dtype'}},\n children: []\n };\n node.signatureKey = arg.name;\n inputs.push(node);\n nodes[nodeName] = node;\n });\n\n const allNodes = Object.keys(nodes);\n allNodes.forEach(key => {\n const node = nodes[key];\n node.inputNames.forEach(name => {\n const [nodeName,] =\ngetNodeNameAndIndex(name);\n node.inputs.push(nodes[nodeName]);\n nodes[nodeName].children.push(node);\n });\n });\n\n const returnNodeMap = functionDef.ret;\n functionDef.signature.outputArg.forEach(output => {\n const [nodeName, index] =\ngetNodeNameAndIndex(returnNodeMap[output.name]);\n const node = nodes[nodeName];\n if (node != null)\n {\n node.defaultOutput\n= index;\n outputs.push(node);\n }\n });\n\n const signature = this.mapArgsToSignature(functionDef);\n return {nodes, inputs, outputs, weights, placeholders, signature};\n }\n\n private\nmapArgsToSignature(functionDef: tensorflow.IFunctionDef):\n tensorflow.ISignatureDef {\n return {\n methodName: functionDef.signature.name,\n inputs: functionDef.signature.inputArg.reduce(\n (map, arg)\n=> {\n map[arg.name] = this.mapArgToTensorInfo(arg);\n return map;\n },\n {})\n as {[key:\nstring]: tensorflow.ITensorInfo}),\n outputs: functionDef.signature.outputArg.reduce(\n (map, arg) => {\n map[arg.name] = this.mapArgToTensorInfo(arg, functionDef.ret);\n return map;\n },\n {})\n as\n{[key: string]: tensorflow.ITensorInfo}),\n }\n }\n\n private mapArgToTensorInfo(\n arg:\ntensorflow.OpDef.IArgDef,\n nameMap?: {[key: string]: string}): tensorflow.ITensorInfo\n {\n let name = arg.name;\n if (nameMap != null) {\n name = nameMap[name];\n }\n return {name,\ndtype: arg.type};\n }\n }\n\n\nexport function decodeBase64(text: string): string {\n const global = env().global;\n if\n(typeof global.atob !== 'undefined') {\n return global.atob(text);\n } else if (typeof Buffer !== 'undefined') {\n\nreturn new Buffer(text, 'base64').toString();\n } else {\n throw new Error(\n `Unable to decode base64 in this\nenvironment. ` +\n `Missing built-in atob() or Buffer());\n }\n }\n\n\nexport function parseStringParam(s: []|string,\nkeepCase: boolean): string {\n const value =\nArray.isArray(s) ? String.fromCharCode.apply(null, s) :\ndecodeBase64(s);\n return keepCase ? value : value.toLowerCase();\n }\n\n\nexport function getStringParam(\nattrs: {[key: string]: tensorflow.IAttrValue}, name: string, def: string,\n keepCase = false): string {\n const param\n= attrs[name];\n if (param != null) {\n return

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 parseStringParam(param.s, keepCase);\n } \n return def;\n}\n\nexport function getBoolParam(\n attrs: {[key:
string]: tensorflow.IAttrValue}, name: string,\n def: boolean): boolean {\n const param = attrs[name];\n return
param ? param.b : def;\n}\n\nexport function getNumberParam(\n attrs: {[key: string]: tensorflow.IAttrValue},
name: string,\n def: number): number {\n const param = attrs[name] || {};\n const value =\n param['i'] != null ?
param['i'] : (param['f'] != null ? param['f'] : def);\n return (typeof value === 'number') ? value : parseInt(value,
10);\n}\n\nexport function parseDtypeParam(value: string|tensorflow.DataType): DataType {\n if (typeof (value)
=== 'string') {\n // tslint:disable-next-line:no-any\n value = tensorflow.DataType[value as any];\n }\n switch
(value) {\n case tensorflow.DataType.DT_FLOAT:\n return 'float32';\n case
tensorflow.DataType.DT_INT32:\n case tensorflow.DataType.DT_INT64:\n case
tensorflow.DataType.DT_INT8:\n case tensorflow.DataType.DT_UINT8:\n return 'int32';\n case tensorflow.DataType.DT_BOOL:\n return
'bool';\n case tensorflow.DataType.DT_DOUBLE:\n return 'float32';\n case
tensorflow.DataType.DT_STRING:\n return 'string';\n default:\n // Unknown dtype error will happen at
runtime (instead of parse time),\n // since these nodes might not be used by the actual subgraph execution.\n
return null;\n }\n}\n\nexport function getFuncParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name:
string,\n def: string): string {\n const param = attrs[name];\n if (param && param.func) {\n return
param.func.name;\n }\n return def;\n}\n\nexport function getDtypeParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def: DataType): DataType {\n const param = attrs[name];\n if (param
&& param.type) {\n return parseDtypeParam(param.type);\n }\n return def;\n}\n\nexport function
getDtypeArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: DataType[]):
DataType[] {\n const param =
attrs[name];\n if (param && param.list && param.list.type) {\n return param.list.type.map(v =>
parseDtypeParam(v));\n }\n return def;\n}\n\nexport function parseTensorShapeParam(shape:
tensorflow.ITensorShape): number[]\n undefined {\n if (shape.unknownRank) {\n return undefined;\n }\n if
(shape.dim != null) {\n return shape.dim.map(\n dim =>\n (typeof dim.size === 'number') ? dim.size :
parseInt(dim.size, 10);\n);\n }\n return [];\n}\n\nexport function getTensorShapeParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def?: number[]): number[]\n undefined {\n const param = attrs[name];\n if
(param && param.shape) {\n return parseTensorShapeParam(param.shape);\n }\n return def;\n}\n\nexport
function getNumericArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: number[]):
number[] {\n const param = attrs[name];\n if (param) {\n return ((param.list.f && param.list.f.length ?
param.list.f :\n param.list.i) ||\n [])\n .map(v => (typeof v === 'number') ?
v : parseInt(v, 10));\n }\n return def;\n}\n\nexport function getStringArrayParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string, def: string[],\n keepCase = false): string[] {\n const param = attrs[name];\n if
(param && param.list && param.list.s) {\n return param.list.s.map((v) => {\n return parseStringParam(v,
keepCase);\n });\n }\n return def;\n}\n\nexport function getTensorShapeArrayParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def: number[][]): number[][] {\n const param = attrs[name];\n if (param
&& param.list && param.list.shape) {\n return param.list.shape.map((v) => {\n return
parseTensorShapeParam(v);\n });\n }\n return def;\n}\n\nexport function
getBoolArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: boolean[]): boolean[]
{\n const param = attrs[name];\n if (param && param.list && param.list.b) {\n return param.list.b;\n }\n return
def;\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
\n\n
===== \n
*/\n\nimport {DataType, Tensor}

```

```

from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext}
from '../executor/execution_context';\nimport {getTensor} from '../executors/utils';\nimport {getBoolArrayParam,
getBoolParam, getDtypeArrayParam, getDtypeParam, getNumberParam, getNumericArrayParam,
getStringArrayParam, getStringParam, getTensorShapeArrayParam, getTensorShapeParam} from
'./operation_mapper';\nimport {GraphNode, Node, ValueType} from './types';\n\n/**\n * Helper class for lookup
inputs and params for nodes in the model graph.\n */\nexport class NodeValueImpl implements GraphNode {\n
public readonly inputs: Tensor[] = [];\n public readonly attrs: {[key: string]: ValueType} = {};\n constructor(\n
private node: Node, private tensorMap: NamedTensorsMap,\n private context: ExecutionContext) {\n
this.inputs = node.inputNames.map(name => this.getInput(name));\n if (node.rawAttrs != null) {\n this.attrs =
Object.keys(node.rawAttrs)\n
.reduce((attrs: {[key: string]: ValueType}, key) => {\n attrs[key] = this.getAttr(key);\n
return attrs;\n }, {});\n }\n }\n\n /**\n * Return the value of the attribute or input
param.\n * @param name String: name of attribute or input param.\n */\n private getInput(name: string): Tensor
{\n return getTensor(name, this.tensorMap, this.context);\n }\n\n /**\n * Return the value of the attribute or
input param.\n * @param name String: name of attribute or input param.\n */\n private getAttr(name: string,
defaultValue?: ValueType): ValueType {\n const value = this.node.rawAttrs[name];\n if (value.tensor != null)
{\n return getTensor(name, this.tensorMap, this.context);\n }\n if (value.i != null || value.f != null) {\n
return getNumberParam(this.node.rawAttrs, name, defaultValue as number);\n }\n if (value.s != null) {\n
return getStringParam(this.node.rawAttrs,
name, defaultValue as string);\n }\n if (value.b != null) {\n return getBoolParam(this.node.rawAttrs, name,
defaultValue as boolean);\n }\n if (value.shape != null) {\n return getTensorShapeParam(\n
this.node.rawAttrs, name, defaultValue as number[]);\n }\n if (value.type != null) {\n return
getDtypeParam(this.node.rawAttrs, name, defaultValue as DataType);\n }\n if (value.list != null) {\n if
(value.list.i != null || value.list.f != null) {\n return getNumericArrayParam(\n this.node.rawAttrs, name,
defaultValue as number[]);\n }\n if (value.list.s != null) {\n return getStringArrayParam(\n
this.node.rawAttrs, name, defaultValue as string[]);\n }\n if (value.list.shape != null) {\n return
getTensorShapeArrayParam(\n this.node.rawAttrs, name, defaultValue as number[][]);\n }\n if
(value.list.b != null) {\n return getBoolArrayParam(\n
this.node.rawAttrs, name, defaultValue as boolean[]);\n }\n if (value.list.type != null) {\n return
getDtypeArrayParam(\n this.node.rawAttrs, name, defaultValue as DataType[]);\n }\n }\n\n return
defaultValue;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */

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=====\n
*/\n\n
* This file exports ops used by the converters executors. By default it\n * re-exports all ops. In a custom build this
is aliased to a file that will\n * only exports ops for a given model.json.\n */\nexport * from './ops';\n\n"/**\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */

```

```

*\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n//
tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\n\nimport {NamedTensorsMap} from '../data/types';\nimport
{ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from
../types';\n\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node:
Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n
case 'BiasAdd':\n case 'AddV2':\n case 'Add': {\n return [tfOps.add(\n (getParamValue('a',
node, tensorMap, context) as Tensor),\n getParamValue('b', node, tensorMap, context) as Tensor)];\n
}\n case 'AddN': {\n return [tfOps.addN((\n getParamValue('tensors', node, tensorMap, context) as
Tensor[]))];\n }\n case 'FloorMod':\n case 'Mod':\n return [tfOps.mod(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap,
context) as Tensor)];\n case 'Mul':\n return [tfOps.mul(\n getParamValue('a', node, tensorMap,
context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n case 'RealDiv':\n
case 'Div': {\n return [tfOps.div(\n getParamValue('a', node, tensorMap, context) as Tensor,\n
getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'DivNoNan': {\n return
[tfOps.divNoNan(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b',
node, tensorMap, context) as Tensor)];\n }\n case 'FloorDiv': {\n return [tfOps.floorDiv(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as
Tensor)];\n }\n case 'Sub': {\n return [tfOps.sub(\n getParamValue('a', node, tensorMap, context) as
Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Minimum': {\n
return [tfOps.minimum(\n getParamValue('a', node, tensorMap, context) as Tensor,\n
getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Maximum': {\n return
[tfOps.maximum(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b',
node, tensorMap, context) as Tensor)];\n }\n case 'Pow': {\n return [tfOps.pow(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as
Tensor)];\n }\n case 'SquaredDifference': {\n return [tfOps.squaredDifference(\n
getParamValue('a', node, tensorMap, context)
as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n default:\n throw
TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const CATEGORY =
'arithmetic';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */

```

```

=====\n
*\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n//
tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\n\nimport {NamedTensorsMap} from '../data/types';\nimport
{ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from
../types';\n\nimport {getParamValue, getTensor} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node:
Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op)
{\n case 'Abs':\n case 'ComplexAbs':\n return [tfOps.abs(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Acos':\n return [tfOps.acos(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Acosh':\n return [tfOps.acosh(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Asin':\n return [tfOps.asin(\n

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 getParamValue('x', node, tensorMap, context) as Tensor));\n case 'Asinh':\n return [tfOps.asinh(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Atan':\n return [tfOps.atan(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Atan2':\n return [tfOps.atan2(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('y', node, tensorMap, context)
as Tensor)];\n case 'Atanh':\n return [tfOps.atanh(\n getParamValue('x', node, tensorMap, context)
as Tensor)];\n case 'Ceil':\n return [tfOps.ceil(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n case 'Complex':\n return [tfOps.complex(\n getParamValue('real', node, tensorMap,
context) as Tensor,\n getParamValue('imag', node, tensorMap, context) as Tensor)];\n case
'Cos':\n return [tfOps.cos(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n case
'Cosh':\n return [tfOps.cosh(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n case
'Elu':\n return [tfOps.elu(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n case
'Erf':\n return [tfOps.erf(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n case
'Exp':\n return [tfOps.exp(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n case
'Expml': {\n return [tfOps.expml(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n
}\n case 'Floor':\n return [tfOps.floor(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n case 'Log':\n return [tfOps.log(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n
 case 'Log1p': {\n return [tfOps.log1p(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n }\n case 'Imag':\n return [tfOps.imag(\n getParamValue('x', node, tensorMap,
context) as Tensor)];\n case 'Neg':\n return [tfOps.neg(\n getParamValue('x', node, tensorMap,
context) as Tensor)];\n case 'Reciprocal': {\n return [tfOps.reciprocal(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n }\n case 'Real':\n return [tfOps.real(\n getParamValue('x',
node, tensorMap, context) as Tensor)];\n case 'Relu':\n return [tfOps.relu(\n getParamValue('x',
node, tensorMap, context) as Tensor)];\n case 'Round': {\n return [tfOps.round(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'Selu':\n return [tfOps.selu(\n
 getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Sigmoid':\n return
[tfOps.sigmoid(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Sin':\n return
[tfOps.sin(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n case 'Sign': {\n return
[tfOps.sign(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'Sinh': {\n
 return [tfOps.sinh(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case
'Softplus': {\n return [tfOps.softplus(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n
 }\n case 'Sqrt': {\n return [tfOps.sqrt(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n }\n case 'Square': {\n return [tfOps.square(\n getParamValue('x', node, tensorMap,
context)
as Tensor)];\n }\n case 'Tanh': {\n return [tfOps.tanh(\n getParamValue('x', node, tensorMap,
context) as Tensor)];\n }\n case 'Tan':\n return [tfOps.tan(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'ClipByValue':\n return [tfOps.clipByValue(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('clipValueMin', node,
tensorMap, context) as number,\n getParamValue('clipValueMax', node, tensorMap, context) as\n
number)];\n case 'Relu6':\n return [tfOps.relu6(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n case 'Rsqrt':\n return [tfOps.rsqrt(\n getTensor(node.inputNames[0], tensorMap,
context))];\n case 'Prod':\n return [tfOps.prod(\n getParamValue('x', node, tensorMap, context) as
Tensor,\n
 getParamValue('axes', node, tensorMap, context) as number[])];\n case 'LeakyRelu':\n return
[tfOps.leakyRelu(\n getParamValue('x', node, tensorMap, context) as Tensor,\n
 getParamValue('alpha', node, tensorMap, context) as number)];\n case 'Prelu':\n return [tfOps.prelu(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('alpha', node, tensorMap,
context) as Tensor)];\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n

```

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};\n\nexport const CATEGORY = 'basic_math';\n", "\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\n/**\n * This differs from util.assertShapesMatch in that it allows values of\n * negative one, an undefined size of a dimension, in a shape to match\n * anything.\n */\n\nimport {Tensor, util} from '@tensorflow/tfjs-core';\n\n/**\n * Used by TensorList and TensorArray to verify if elementShape matches, support\n * negative value as the dim shape.\n */\n\n@param shapeA\n * @param shapeB\n * @param errorMessagePrefix\n */\n\nexport function assertShapesMatchAllowUndefinedSize(\n shapeA: number|number[], shapeB: number|number[],\n errorMessagePrefix = \"\"): void {\n // constant shape means unknown rank\n if (typeof shapeA === 'number' ||\n typeof shapeB === 'number') {\n return;\n }\n util.assert(\n shapeA.length === shapeB.length,\n () => errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must match`);\n for (let i = 0; i < shapeA.length; i++) {\n const dim0 = shapeA[i];\n const dim1 = shapeB[i];\n util.assert(\n dim0 < 0 || dim1 < 0 || dim0 === dim1,\n () => errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must match`);\n }\n}\n\nexport function fullDefinedShape(elementShape: number|number[]): boolean {\n if (typeof elementShape === 'number' ||\n elementShape.some(dim => dim < 0)) {\n return false;\n }\n return true;\n}\n\n/**\n * Generate the output element shape from the list elementShape, list tensors\n * and input param.\n */\n\n@param listElementShape\n * @param tensors\n * @param elementShape\n */\n\nexport function inferElementShape(\n listElementShape: number|number[], tensors: Tensor[],\n elementShape: number|number[]): number[] {\n let partialShape = mergeElementShape(listElementShape, elementShape);\n const notfullDefinedShape = !fullDefinedShape(partialShape);\n if (notfullDefinedShape && tensors.length === 0) {\n throw new Error(\n `Tried to calculate elements of an empty list` +\n ` with non-fully-defined elementShape: ${partialShape}`);\n }\n if (notfullDefinedShape) {\n tensors.forEach(tensor => {\n partialShape = mergeElementShape(tensor.shape, partialShape);\n });\n }\n if (!fullDefinedShape(partialShape)) {\n throw new Error(`Non-fully-defined elementShape: ${partialShape}`);\n }\n return partialShape as number[];\n}\n\nexport function mergeElementShape(\n elementShapeA: number|number[], elementShapeB: number|number[]): number|\n number[] {\n if (typeof elementShapeA === 'number') {\n return elementShapeB;\n }\n if (typeof elementShapeB === 'number') {\n return elementShapeA;\n }\n if (elementShapeA.length !== elementShapeB.length) {\n throw new Error(`Incompatible ranks during merge: ${elementShapeA} vs. ${\n elementShapeB}`);\n }\n const result: number[] = [];\n for (let i = 0; i < elementShapeA.length; ++i) {\n const dim0 = elementShapeA[i];\n const dim1 = elementShapeB[i];\n if (dim0 >= 0 && dim1 >= 0 && dim0 !== dim1) {\n throw new Error(`Incompatible shape during merge: ${elementShapeA} vs. ${\n elementShapeB}`);\n }\n result[i] = dim0 >= 0 ? dim0 : dim1;\n }\n return result;\n}\n", "\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n * or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*/\n\nimport {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from '@tensorflow/tfjs-core';\n\nimport {assertShapesMatchAllowUndefinedSize} from './tensor_utils';\n\nexport
```

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interface TensorWithState {\n tensor?: Tensor;\n written?: boolean;\n read?: boolean;\n cleared?:
boolean;\n}\n/**\n * The TensorArray object keeps an array of Tensors. It\n * allows reading from the array and
writing to the array.\n */\nexport class TensorArray {\n private tensors: TensorWithState[] = [];\n private closed_ =
false;\n readonly idTensor: Tensor;\n constructor(\n readonly name: string, readonly dtype: DataType, private
maxSize: number,\n private elementShape: number[], readonly identicalElementShapes: boolean,\n readonly
dynamicSize: boolean,\n readonly clearAfterRead: boolean) {\n this.idTensor = scalar(0);\n keep(this.idTensor);\n }\n get id() {\n
return this.idTensor.id;\n }\n get closed() {\n return this.closed_;\n }\n /**\n * Dispose the tensors and
idTensor and mark the TensorArray as closed.\n */\n clearAndClose(keepIds?: Set<number>) {\n
this.tensors.forEach(tensor => {\n if (keepIds == null || !keepIds.has(tensor.tensor.id)) {\n
tensor.tensor.dispose();\n }\n });\n this.tensors = [];\n this.closed_ = true;\n this.idTensor.dispose();\n
}\n size(): number {\n return this.tensors.length;\n }\n /**\n * Read the value at location index in the
TensorArray.\n * @param index Number the index to read from.\n */\n read(index: number): Tensor {\n if
(this.closed_) {\n throw new Error(`TensorArray ${this.name} has already been closed.`);\n }\n if (index <
0 || index >= this.size()) {\n throw new Error(`Tried to read from index
${index}, but array size is: ${\n this.size()}`);\n }\n const tensorWithState = this.tensors[index];\n if
(tensorWithState.cleared) {\n throw new Error(`\n `TensorArray ${this.name}: Could not read index ${\n
 index} twice because it was cleared after a previous read `+\n `(perhaps try setting clear_after_read =
false?`.)`);\n }\n if (this.clearAfterRead) {\n tensorWithState.cleared = true;\n }\n tensorWithState.read
= true;\n return tensorWithState.tensor;\n }\n /**\n * Helper method to read multiple tensors from the
specified indices.\n */\n readMany(indices: number[]): Tensor[] {\n return indices.map(index =>
this.read(index));\n }\n /**\n * Write value into the index of the TensorArray.\n * @param index number the
index to write to.\n * @param tensor\n */\n write(index: number, tensor: Tensor) {\n if (this.closed_) {\n
throw new Error(`TensorArray ${this.name} has already
been closed.`);\n }\n if (index < 0 || !this.dynamicSize && index >= this.maxSize) {\n throw new
Error(`Tried to write to index ${\n index}, but array is not resizeable and size is: ${this.maxSize}`);\n }\n
const t = this.tensors[index] || {};\n if (tensor.dtype !== this.dtype) {\n throw new Error(`TensorArray ${\n
 this.name}: Could not write to TensorArray index ${index},\n because the value dtype is ${\n
 tensor.dtype}, but TensorArray dtype is ${this.dtype}.`);\n }\n // Set the shape for the first time write to
unknow shape tensor array\n if (this.size() === 0 &&\n (this.elementShape == null || this.elementShape.length
=== 0)) {\n this.elementShape = tensor.shape;\n }\n assertShapesMatchAllowUndefinedSize(\n
this.elementShape, tensor.shape,\n `TensorArray ${this.name}: Could not write to TensorArray index ${\n
 index}.`);\n if (t.read) {\n throw new Error(\n
 `TensorArray ${this.name}: Could not write to TensorArray index ${\n index}, because it has already
been read.`);\n }\n if (t.written) {\n throw new Error(\n `TensorArray ${this.name}: Could not write
to TensorArray index ${\n index}, because it has already been written.`);\n }\n t.tensor = tensor;\n
keep(tensor);\n t.written = true;\n this.tensors[index] = t;\n }\n /**\n * Helper method to write multiple
tensors to the specified indices.\n */\n writeMany(indices: number[], tensors: Tensor[]) {\n if (indices.length !==
tensors.length) {\n throw new Error(\n `TensorArray ${this.name}: could not write multiple tensors, `+\n
 `because the index size: ${\n indices.length} is not the same as tensors size: ${\n
 tensors.length}.`);\n }\n indices.forEach((i, index) => this.write(i, tensors[index]));\n }\n /**\n * Return
selected values in the
TensorArray as a packed Tensor. All of\n * selected values must have been written and their shapes must all
match.\n * @param [indices] number[] Optional. Taking values in [0, max_value). If the\n * TensorArray is not
dynamic, max_value=size(). If not specified returns\n * all tensors in the original order.\n * @param [dtype]\n
*/\n gather(indices?: number[], dtype?: DataType): Tensor {\n if (!dtype && dtype !== this.dtype) {\n throw
new Error(`TensorArray dtype is ${\n this.dtype} but gather requested dtype ${dtype}`);\n }\n if
(!indices) {\n indices = [];\n for (let i = 0; i < this.size(); i++) {\n indices.push(i);\n }\n }
else {\n

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indices = indices.slice(0, this.size());\n }\n\n if (indices.length === 0) {\n return tensor([],\n [0].concat(this.elementShape));\n }\n\n // Read all the PersistentTensors into a vector to keep track of\n // their\n memory.\n const tensors = this.readMany(indices);\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape, tensors[0].shape, 'TensorArray shape\n mismatch:');\n\n return stack(tensors, 0);\n }\n\n /**\n * Return the values in the TensorArray as a concatenated\n Tensor.\n * ^\n * concat(dtype?: DataType): Tensor {\n * if (!!dtype && dtype !== this.dtype) {\n * throw new\n Error(`TensorArray dtype is ${\n this.dtype} but concat requested dtype ${dtype}`);\n * }\n * if (this.size()\n === 0) {\n * return tensor([], [0].concat(this.elementShape));\n * }\n * const indices = [];\n * for (let i = 0; i <\n this.size(); i++) {\n * indices.push(i);\n * }\n * // Collect all the tensors from the tensors array.\n * const tensors =\n this.readMany(indices);\n * assertShapesMatchAllowUndefinedSize(\n this.elementShape, tensors[0].shape,\n '\n `TensorArray shape mismatch: tensor array shape (${this.elementShape})\n vs first tensor shape\n (${tensors[0].shape})`);\n * return concat(tensors,\n 0);\n }\n\n /**\n * Scatter the values of a Tensor in specific indices of a TensorArray.\n * @param indices\n nummber[] values in [0, max_value). If the\n * TensorArray is not dynamic, max_value=size().\n * @param\n tensor Tensor input tensor.\n * ^\n * scatter(indices: number[], tensor: Tensor) {\n * if (tensor.dtype !== this.dtype)\n {\n * throw new Error(`TensorArray dtype is ${\n this.dtype} but tensor has dtype ${tensor.dtype}`);\n * }\n * if (indices.length !== tensor.shape[0]) {\n * throw new Error(`Expected len(indices) ==\n tensor.shape[0], but\n saw: ${\n indices.length} vs. ${tensor.shape[0]}`);\n * }\n * const maxIndex = Math.max(...indices);\n * if\n (!this.dynamicSize && maxIndex >= this.maxSize) {\n * throw new Error(\n `Max index must be < array\n size (${maxIndex} vs. ${this.maxSize})`);\n * }\n * this.writeMany(indices, unstack(tensor, 0));\n }\n\n /**\n * Split the values of a Tensor into the TensorArray.\n *\n * @param length number[] with the lengths to use when splitting value along\n * its first dimension.\n *\n * @param tensor Tensor, the tensor to split.\n * ^\n * split(length: number[], tensor: Tensor) {\n * if (tensor.dtype !==\n this.dtype) {\n * throw new Error(`TensorArray dtype is ${\n this.dtype} but tensor has dtype\n ${tensor.dtype}`);\n * }\n * let totalLength = 0;\n * const cumulativeLengths = length.map(len => {\n totalLength\n += len;\n * return totalLength;\n * });\n * if (totalLength !== tensor.shape[0]) {\n * throw new\n Error(`Expected sum of lengths to be equal to\n tensor.shape[0], but sum of lengths is\n ${totalLength},\n and tensor's shape is: ${tensor.shape}`);\n * }\n * if (!this.dynamicSize && length.length !== this.maxSize) {\n * throw new Error(\n `TensorArray's size is not equal to the size of\n lengths (${this.maxSize} vs.\n ${length.length}),\n ` and the TensorArray is\n not marked as dynamically resizable`);\n * }\n * const elementPerRow = totalLength === 0 ? 0 :\n tensor.size /\n totalLength;\n * const tensors: Tensor[] = [];\n * tidy(() => {\n * tensor = reshape(tensor, [1, totalLength,\n elementPerRow]);\n * for (let i = 0; i < length.length; ++i) {\n * const previousLength = (i === 0) ? 0 :\n cumulativeLengths[i\n - 1];\n * const indices = [0, previousLength, 0];\n * const sizes = [1, length[i],\n elementPerRow];\n * tensors[i] = reshape(slice(tensor, indices,\n sizes), this.elementShape);\n * }\n * return\n tensors;\n * });\n * const indices = [];\n * for (let i = 0; i < length.length; i++) {\n * indices[i] = i;\n * }\n * this.writeMany(indices, tensors);\n }\n\n }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n 'License');\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an\n 'AS IS'\n BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express\n or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n }\n\n =====\n\n *\n import {concat, DataType, keep, reshape, scalar,\n slice, stack, Tensor, tensor, tidy, unstack} from\n '@tensorflow/tfjs-core';\n import {assertShapesMatchAllowUndefinedSize,\n inferElementShape,\n mergeElementShape} from './tensor_utils';\n\n /**\n * TensorList stores a container of `tf.Tensor`\n objects, which are\n accessible\n * via tensors field.\n *\n * In order to get a copy of the underlying list, use the\n copy method.\n **

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TensorList b = a.copy();\n * b.tensors().pushBack(t); // This does not modify a.tensors().\n
* ```\n *\n * Note that this is not a deep copy: the memory locations of the underlying\n * tensors will still point to
the same locations of the corresponding tensors\n * in the original.\n *^\n\nexport class TensorList {\n readonly
idTensor: Tensor;\n maxNumElements: number;\n\n get id() {\n return this.idTensor.id;\n }\n /**\n *\n * @param tensors list of tensors\n * @param elementShape shape of each tensor, this can be a single number (any\n * shape is allowed) or partial shape (dim = -1).\n * @param elementDtype data type of each tensor\n * @param
maxNumElements The maximum allowed size of `tensors`. Defaults to -1\n * meaning that the size of `tensors` is
unbounded.\n *^\n constructor(\n readonly tensors: Tensor[], readonly elementShape: number|number[],\n readonly elementDtype: DataType, maxNumElements = -1) {\n if (tensors !== null) {\n tensors.forEach(tensor
=> {\n if (elementDtype !== tensor.dtype) {\n throw new Error(`Invalid
data types; op elements ${\n elementDtype}, but list elements ${tensor.dtype}`);\n }\n assertShapesMatchAllowUndefinedSize(\n elementShape, tensor.shape, 'TensorList shape mismatch: ');\n \n keep(tensor);\n });\n }\n this.idTensor = scalar(0);\n this.maxNumElements = maxNumElements;\n keep(this.idTensor);\n }\n\n /**\n *\n * Get a new TensorList containing a copy of the underlying tensor container.\n *^\n copy(): TensorList {\n return new TensorList(\n [...this.tensors], this.elementShape,
this.elementDtype);\n }\n\n /**\n *\n * Dispose the tensors and idTensor and clear the tensor list.\n *^\n clearAndClose(keepIds?: Set<number>) {\n this.tensors.forEach(tensor => {\n if (keepIds == null ||
!keepIds.has(tensor.id)) {\n tensor.dispose();\n }\n });\n this.tensors.length = 0;\n this.idTensor.dispose();\n }\n\n /**\n *\n * The size of the tensors in the tensor list.\n *^\n size() {\n return this.tensors.length;\n }\n\n /**\n *\n * Return a tensor that stacks a list of rank-R tf.Tensors into
one rank-(R+1)\n * tf.Tensor.\n * @param elementShape shape of each tensor\n * @param elementDtype data
type of each tensor\n * @param numElements the number of elements to stack\n *^\n stack(elementShape:
number[], elementDtype: DataType, numElements = -1):\n Tensor {\n if (elementDtype !== this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list elements
${this.elementDtype}`);\n }\n if (numElements !== -1 && this.tensors.length !== numElements) {\n throw
new Error(`Operation expected a list with ${\n numElements} elements but got a list with ${\n this.tensors.length} elements.`);\n }\n assertShapesMatchAllowUndefinedSize(\n elementShape,
this.elementShape, 'TensorList shape mismatch: ');\n const outputElementShape =\n inferElementShape(this.elementShape,
this.tensors, elementShape);\n return tidy(() => {\n const reshapedTensors =\n this.tensors.map(tensor =>
reshape(tensor, outputElementShape));\n return stack(reshapedTensors, 0);\n });\n }\n\n /**\n *\n * Pop a tensor
from the end of the list.\n * @param elementShape shape of the tensor\n * @param elementDtype data type of the
tensor\n *^\n popBack(elementShape: number[], elementDtype: DataType): Tensor {\n if (elementDtype !==
this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list
elements ${this.elementDtype}`);\n }\n if (this.size() === 0) {\n throw new Error('Trying to pop from an
empty list.);\n }\n const outputElementShape =\n inferElementShape(this.elementShape, this.tensors,
elementShape);\n const tensor = this.tensors.pop();\n assertShapesMatchAllowUndefinedSize(\n tensor.shape, elementShape, 'TensorList shape mismatch:
');\n return reshape(tensor, outputElementShape);\n }\n\n /**\n *\n * Push a tensor to the end of the list.\n *
@param tensor Tensor to be pushed.\n *^\n pushBack(tensor: Tensor) {\n if (tensor.dtype !===
this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n tensor.dtype}, but list
elements ${this.elementDtype}`);\n }\n assertShapesMatchAllowUndefinedSize(\n tensor.shape,
this.elementShape, 'TensorList shape mismatch: ');\n if (this.maxNumElements === this.size()) {\n throw
new Error('Trying to push element into a full list.);\n }\n keep(tensor);\n this.tensors.push(tensor);\n }\n\n /**\n *\n * Update the size of the list.\n * @param size the new size of the list.\n *^\n resize(size: number) {\n if
(size < 0) {\n throw new Error(`\n `TensorListResize expects size to be non-negative. Got: ${size}`);\n }\n if (this.maxNumElements !== -1 && size > this.maxNumElements) {\n

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 throw new Error(`TensorListResize input size ${\n size} is greater maxNumElement
${this.maxNumElements}`);\n }\n this.tensors.length = size;\n }\n\n /**\n * Retrieve the element at the
provided index\n * @param elementShape shape of the tensor\n * @param elementDtype dtype of the tensor\n *
@param elementIndex index of the tensor\n */\n getItem(elementIndex: number, elementShape: number[],
elementDtype: DataType):\n Tensor {\n if (elementDtype !== this.elementDtype) {\n throw new
Error(`Invalid data types; op elements ${\n elementDtype}, but list elements ${this.elementDtype}`);\n }\n
if (elementIndex < 0 || elementIndex > this.tensors.length) {\n throw new Error(`Trying to access element ${\n
 elementIndex} in a list with ${this.tensors.length} elements.`);\n }\n\n if (this.tensors[elementIndex] == null)\n {\n throw new Error(`element at index ${elementIndex} is null.`);\n }\n\n assertShapesMatchAllowUndefinedSize(\n
 this.tensors[elementIndex].shape, elementShape,\n `TensorList shape mismatch:`);\n const
outputElementShape =\n inferElementShape(this.elementShape, this.tensors, elementShape);\n return
reshape(this.tensors[elementIndex], outputElementShape);\n }\n\n /**\n * Set the tensor at the index\n *
@param elementIndex index of the tensor\n * @param tensor the tensor to be inserted into the list\n */\n setItem(elementIndex: number, tensor: Tensor) {\n if (tensor.dtype !== this.elementDtype) {\n throw new
Error(`Invalid data types; op elements ${\n tensor.dtype}, but list elements ${this.elementDtype}`);\n }\n
if (elementIndex < 0 ||\n this.maxNumElements !== -1 && elementIndex >= this.maxNumElements) {\n throw new Error(`Trying to set element ${\n
 elementIndex} in a list with max ${this.maxNumElements}
elements.`);\n }\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape,\n tensor.shape, `TensorList shape mismatch:`);\n keep(tensor);\n this.tensors[elementIndex] = tensor;\n }\n\n /**\n * Return selected values in the TensorList as a stacked Tensor. All of\n * selected values must have been
written and their shapes must all match.\n * @param indices indices of tensors to gather\n * @param
elementDtype output tensor dtype\n * @param elementShape output tensor element shape\n */\n gather(indices:
number[], elementDtype: DataType, elementShape: number[]):\n Tensor {\n if (elementDtype !==
this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list
elements ${this.elementDtype}`);\n }\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape,\n elementShape, `TensorList shape mismatch:`);\n\n // When indices is greater than the size of the list, indices
beyond the\n // size of the list are ignored.\n indices = indices.slice(0, this.size());\n const
outputElementShape =\n inferElementShape(this.elementShape, this.tensors, elementShape);\n if
(indices.length === 0) {\n return tensor([], [0].concat(outputElementShape));\n }\n\n return tidy(() => {\n
const tensors =\n indices.map(i => reshape(this.tensors[i], outputElementShape));\n return stack(tensors,
0);\n });\n }\n\n /**\n * Return the values in the TensorList as a concatenated Tensor.\n * @param
elementDtype output tensor dtype\n * @param elementShape output tensor element shape\n */\n concat(elementDtype: DataType, elementShape: number[]): Tensor {\n if (!elementDtype && elementDtype !==
this.elementDtype) {\n throw new Error(`TensorList dtype is ${\n this.elementDtype} but concat requested
dtype ${elementDtype}`);\n }\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape,\n elementShape, `TensorList shape mismatch:`);\n const outputElementShape =\n inferElementShape(this.elementShape,\n this.tensors, elementShape);\n\n if (this.size() === 0) {\n return tensor([], [0].concat(outputElementShape));\n }\n return tidy(() => {\n const tensors = this.tensors.map(t => reshape(t, outputElementShape));\n return
concat(tensors, 0);\n });\n }\n\n /**\n * Creates a TensorList which, when stacked, has the value of tensor.\n *
@param tensor from tensor\n * @param elementShape output tensor element shape\n */\n export function
fromTensor(\n tensor: Tensor, elementShape: number[], elementDtype: DataType) {\n const dtype =
tensor.dtype;\n if (tensor.shape.length < 1) {\n throw new Error(`\n `Tensor must be at least a vector, but saw
shape: ${tensor.shape}`);\n }\n if (tensor.dtype !== elementDtype) {\n throw new Error(`Invalid data types; op
elements ${\n tensor.dtype}, but list elements ${elementDtype}`);\n }\n const tensorElementShape =
tensor.shape.slice(1);\n assertShapesMatchAllowUndefinedSize(\n tensorElementShape,

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elementShape, 'TensorList shape mismatch: ');
 const tensorList: Tensor[] = unstack(tensor);
 return new
TensorList(tensorList, elementShape, dtype);
}

/**
 * Return a TensorList of the given size with empty
elements.
 * @param elementShape the shape of the future elements of the list
 * @param elementDtype the desired type of elements in the list
 * @param numElements the number of elements to reserve
 */
export
function reserve(
 elementShape: number[], elementDtype: DataType, numElements: number) {
 return new
TensorList([], elementShape, elementDtype, numElements);
}

/**
 * Put tensors at specific indices of a
stacked tensor into a TensorList.
 * @param indices list of indices on how to scatter the tensor.
 * @param tensor
input tensor.
 * @param elementShape the shape of the future elements of the list
 * @param numElements the
number of elements to scatter
 */
export
function scatter(
 tensor: Tensor, indices: number[], elementShape:
number[],
numElements?: number): TensorList {
 if (indices.length !== tensor.shape[0]) {
 throw new Error(`Expected
len(indices) == tensor.shape[0], but saw: ${
indices.length} vs. ${tensor.shape[0]}`);
 }

 const maxIndex
= Math.max(...indices);
 if (numElements != null && numElements !== -1 && maxIndex >= numElements) {
 throw new Error(`
Max index must be < array size (${maxIndex} vs. ${numElements})`);
 }

 const list
= new TensorList([], elementShape, tensor.dtype, numElements);
 const tensors = unstack(tensor, 0);
 indices.forEach((value, index) => {
 list.setItem(value, tensors[index]);
 });
 return list;
}

/**
 * Split the
values of a Tensor into a TensorList.
 * @param length the lengths to use when splitting value along
 * its first
dimension.
 * @param tensor the tensor to split.
 * @param elementShape the shape of the future elements of the
list
 */
export
function split(
 tensor: Tensor, length: number[],
elementShape: number[]) {
 let totalLength = 0;
 const cumulativeLengths = length.map(len => {
totalLength += len;
return totalLength;
});
 if (totalLength !== tensor.shape[0]) {
 throw new
Error(`Expected sum of lengths to be equal to
tensor.shape[0], but sum of lengths is
${totalLength},
and tensor's shape is: ${tensor.shape}`);
 }

 const shapeWithoutFirstDim = tensor.shape.slice(1);
 const
outputElementShape = mergeElementShape(shapeWithoutFirstDim, elementShape);
 const elementPerRow =
totalLength === 0 ? 0 : tensor.size / totalLength;
 const tensors: Tensor[] = tidy(() => {
 const tensors = [];
 tensor = reshape(tensor, [1, totalLength, elementPerRow]);
 for (let i = 0; i < length.length; ++i) {
 const
previousLength = (i === 0) ? 0 : cumulativeLengths[i - 1];
 const indices = [0, previousLength, 0];
 const
sizes = [1, length[i], elementPerRow];
 tensors[i] = reshape(
slice(tensor, indices, sizes), outputElementShape as number[]);
 }
 tensor.dispose();
 return tensors;
 });
 const list = new TensorList([], elementShape, tensor.dtype, length.length);
 for (let i = 0; i <
tensors.length; i++) {
 list.setItem(i, tensors[i]);
 }
 return list;
}

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 */
=====
import {DataType, scalar, Tensor} from '@tensorflow/tfjs-core';
import {NamedTensorsMap} from
'../data/types';
import {ExecutionContext} from '../executor/execution_context';
import {TensorArray} from
'../executor/tensor_array';
import {fromTensor, reserve, scatter, split} from '../executor/tensor_list';
import
{InternalOpAsyncExecutor, Node} from '../types';
import {cloneTensor, getParamValue, getTensor} from
'./utils';
export
const executeOp: InternalOpAsyncExecutor = async(
 node: Node, tensorMap:
NamedTensorsMap,
context: ExecutionContext): Promise<Tensor[]> => {
 switch (node.op) {
 case 'If':
 case 'StatelessIf': {
 const thenFunc =
getParamValue('thenBranch', node, tensorMap, context) as
string;
 const elseFunc =
getParamValue('elseBranch', node, tensorMap, context) as
string;
 const
cond = getParamValue('cond', node, tensorMap, context) as
Tensor;

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const args = getParamValue('args', node, tensorMap, context) as Tensor[];
const condValue = await
cond.data();
if (condValue[0]) {
return context.functionMap[thenFunc].executeFunctionAsync(
args, context.tensorArrayMap, context.tensorListMap);
} else {
return
context.functionMap[elseFunc].executeFunctionAsync(
args, context.tensorArrayMap,
context.tensorListMap);
}
}
case 'While':
case 'StatelessWhile': {
const bodyFunc =
getParamValue('body', node, tensorMap, context) as string;
const condFunc =
getParamValue('cond',
node, tensorMap, context) as string;
const args = getParamValue('args', node, tensorMap, context) as
Tensor[];
// Calculate the condition of the loop
const condResult =
(await
context.functionMap[condFunc].executeFunctionAsync(
args, context.tensorArrayMap,
context.tensorListMap));
const argIds =
args.map(tensor => tensor.id);
let condValue = await condResult[0].data();
// Dispose the intermediate
tensors for condition function
condResult.forEach(tensor => {
if (!tensor.kept &&
argIds.indexOf(tensor.id) === -1) {
tensor.dispose();
}
});
let result: Tensor[] = args;
while (condValue[0]) {
// Record the previous result for intermediate tensor tracking
const origResult =
result;
// Execution the body of the loop
result = await
context.functionMap[bodyFunc].executeFunctionAsync(
result, context.tensorArrayMap,
context.tensorListMap);
const resultIds = result.map(tensor => tensor.id);
// Dispose the intermediate
tensor for body function that is not global
// kept, not input/output of the body function
origResult.forEach(tensor => {
if (!tensor.kept && argIds.indexOf(tensor.id) === -1 &&
resultIds.indexOf(tensor.id)
=== -1) {
tensor.dispose();
}
});
// Recalculate the condition of the loop using the
latest results.
const condResult =
(await context.functionMap[condFunc].executeFunctionAsync(
result, context.tensorArrayMap, context.tensorListMap));
condValue = await condResult[0].data();
// Dispose the intermediate tensors for condition function
condResult.forEach(tensor => {
if
(!tensor.kept && argIds.indexOf(tensor.id) === -1 &&
resultIds.indexOf(tensor.id) === -1) {
tensor.dispose();
}
});
}
return result;
}
case 'LoopCond': {
const pred =
getParamValue('pred', node, tensorMap, context) as Tensor;
return [cloneTensor(pred)];
}
case 'Switch': {
const pred = getParamValue('pred', node, tensorMap, context) as Tensor;
let data =
getParamValue('data', node,
tensorMap, context) as Tensor;
if (!data.kept) {
data = cloneTensor(data);
}
// Outputs nodes
:0 => false, :1 => true
return (await pred.data())[0] ? [undefined, data] : [data, undefined];
}
case
'Merge': {
const inputName = node.inputNames.find(
name => getTensor(name, tensorMap, context)
!== undefined);
if (inputName) {
const data = getTensor(inputName, tensorMap, context);
return
[cloneTensor(data)];
}
return undefined;
}
case 'Enter': {
const frameId =
getParamValue('frameName', node, tensorMap, context) as string;
const data = getParamValue('tensor', node,
tensorMap, context) as Tensor;
context.enterFrame(frameId);
return [cloneTensor(data)];
}
case
'Exit': {
const data = getParamValue('tensor', node, tensorMap, context) as Tensor;
context.exitFrame();
return [cloneTensor(data)];
}
case 'NextIteration': {
const data = getParamValue('tensor', node, tensorMap, context) as Tensor;
context.nextIteration();
return [cloneTensor(data)];
}
case 'TensorArrayV3': {
const size = getParamValue('size', node,
tensorMap, context) as number;
const dtype =
getParamValue('dtype', node, tensorMap, context) as
DataType;
const elementShape =
getParamValue('elementShape', node, tensorMap, context) as
number[];
const dynamicSize =
getParamValue('dynamicSize', node, tensorMap, context) as boolean;
const clearAfterRead =
getParamValue('clearAfterRead', node, tensorMap, context) as boolean;
const
identicalElementShapes =
getParamValue('identicalElementShapes', node, tensorMap, context) as
boolean;
const name = getParamValue('name', node, tensorMap, context) as string;
const tensorArray =
new TensorArray(
name, dtype, size, elementShape,

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 identicalElementShapes, dynamicSize, \n clearAfterRead); \n context.addTensorArray(tensorArray); \n
return [tensorArray.idTensor, scalar(1.0)]; \n } \n case 'TensorArrayWriteV3': { \n const id = \n
getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const index = getParamValue('index',
node, tensorMap, context) as number; \n const writeTensor = \n getParamValue('tensor', node, tensorMap,
context) as Tensor; \n const writeTensorArray = context.getTensorArray(id.id); \n
writeTensorArray.write(index, writeTensor); \n return [writeTensorArray.idTensor]; \n } \n case
'TensorArrayReadV3': { \n const readId = \n getParamValue('tensorArrayId', node, tensorMap, context) as
Tensor; \n const readIndex = \n getParamValue('index', node, tensorMap, context) as number; \n const
readTensorArray = context.getTensorArray(readId.id); \n return [readTensorArray.read(readIndex)]; \n } \n
 case 'TensorArrayGatherV3': { \n const gatherId = \n getParamValue('tensorArrayId', node, tensorMap,
context) as Tensor; \n const gatherIndices = \n getParamValue('indices', node, tensorMap, context) as
number[]; \n const gatherDType = \n getParamValue('dtype', node, tensorMap, context) as DataType; \n const gatherTensorArray =
context.getTensorArray(gatherId.id); \n return
[gatherTensorArray.gather(gatherIndices, gatherDType)]; \n } \n case 'TensorArrayScatterV3': { \n const
scatterId = \n getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const scatterIndices
= \n getParamValue('indices', node, tensorMap, context) as number[]; \n const scatterTensor = \n
getParamValue('tensor', node, tensorMap, context) as Tensor; \n const scatterTensorArray =
context.getTensorArray(scatterId.id); \n scatterTensorArray.scatter(scatterIndices, scatterTensor); \n return
[scatterTensorArray.idTensor]; \n
 } \n case 'TensorArrayConcatV3': { \n const concatId = \n getParamValue('tensorArrayId', node,
tensorMap, context) as Tensor; \n const concatTensorArray = context.getTensorArray(concatId.id); \n const
concatDType = \n getParamValue('dtype', node, tensorMap, context) as DataType; \n return
[concatTensorArray.concat(concatDType)]; \n } \n case 'TensorArraySplitV3': { \n const splitId = \n
getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const splitTensor = \n
getParamValue('tensor', node, tensorMap, context) as Tensor; \n const lengths = \n getParamValue('lengths',
node, tensorMap, context) as number[]; \n const splitTensorArray = context.getTensorArray(splitId.id); \n
splitTensorArray.split(lengths, splitTensor); \n return [splitTensorArray.idTensor]; \n } \n case
'TensorArraySizeV3': { \n const sizeId = \n getParamValue('tensorArrayId', node,
tensorMap, context) as Tensor; \n const sizeTensorArray = context.getTensorArray(sizeId.id); \n return
[scalar(sizeTensorArray.size(), 'int32')]; \n } \n case 'TensorArrayCloseV3': { \n const closeId = \n
getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const closeTensorArray =
context.getTensorArray(closeId.id); \n closeTensorArray.clearAndClose(); \n return
[closeTensorArray.idTensor]; \n } \n case 'TensorListSetItem': { \n const idTensor = \n
getParamValue('tensorListId', node, tensorMap, context) as Tensor; \n const index = getParamValue('index', node,
tensorMap, context) as number; \n const writeTensor = \n getParamValue('tensor', node, tensorMap, context)
as Tensor; \n const tensorList = context.getTensorList(idTensor.id); \n tensorList.setItem(index,
writeTensor); \n return [tensorList.idTensor]; \n } \n case 'TensorListGetItem': { \n const idTensor = \n
getParamValue('tensorListId',
node, tensorMap, context) as Tensor; \n const readIndex = \n getParamValue('index', node, tensorMap,
context) as number; \n const elementShape = \n getParamValue('elementShape', node, tensorMap, context)
as number[]; \n const elementDType = \n getParamValue('elementDType', node, tensorMap, context) as
DataType; \n const tensorList = context.getTensorList(idTensor.id); \n return [tensorList.getItem(readIndex,
elementShape, elementDType)]; \n } \n case 'TensorListScatterV2': \n case 'TensorListScatter': { \n const
scatterIndices = \n getParamValue('indices', node, tensorMap, context) as number[]; \n const scatterTensor
= \n getParamValue('tensor', node, tensorMap, context) as Tensor; \n const elementShape = \n
getParamValue('elementShape', node, tensorMap, context) as number[]; \n const numElements = \n
getParamValue('numElements', node, tensorMap, context) as number; \n

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const tensorList =\n scatter(scatterTensor, scatterIndices, elementShape, numElements);\ncontext.addTensorList(tensorList);\n return [tensorList.idTensor];\n}\n case 'TensorListReserve':\n case 'EmptyTensorList': {\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as DataType;\n let numElementsParam;\n if (node.op === 'TensorListReserve') {\n numElementsParam = 'numElements';\n } else {\n numElementsParam = 'maxNumElements';\n }\n const numElements =\n getParamValue(numElementsParam, node, tensorMap, context) as number;\n const tensorList = reserve(elementShape, elementDType, numElements);\n context.addTensorList(tensorList);\n return [tensorList.idTensor];\n}\n case 'TensorListGather': {\n const gatherId =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const gatherIndices =\n getParamValue('indices', node, tensorMap, context) as number[];\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as DataType;\n const tensorList = context.getTensorList(gatherId.id);\n return [tensorList.gather(gatherIndices, elementDType, elementShape)];\n}\n case 'TensorListStack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as DataType;\n const numElements =\n getParamValue('numElements', node, tensorMap, context) as number;\n const tensorList = context.getTensorList(idTensor.id);\n return [tensorList.stack(elementShape, elementDType, numElements)];\n}\n case 'TensorListFromTensor': {\n const tensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as DataType;\n const tensorList = fromTensor(tensor, elementShape, elementDType);\n context.addTensorList(tensorList);\n return [tensorList.idTensor];\n}\n case 'TensorListConcat': {\n const concatId =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const tensorList = context.getTensorList(concatId.id);\n const concatDType =\n getParamValue('dtype', node, tensorMap, context) as DataType;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n return [tensorList.concat(concatDType, elementShape)];\n}\n case 'TensorListPushBack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const writeTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const tensorList = context.getTensorList(idTensor.id);\n tensorList.pushBack(writeTensor);\n return [tensorList.idTensor];\n}\n case 'TensorListPopBack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as DataType;\n const tensorList = context.getTensorList(idTensor.id);\n return [tensorList.popBack(elementShape, elementDType)];\n}\n case 'TensorListSplit': {\n const splitTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const lengths =\n getParamValue('lengths', node, tensorMap, context) as number[];\n const tensorList = split(splitTensor, lengths, elementShape);\n context.addTensorList(tensorList);\n return [tensorList.idTensor];\n}\n default:\n throw TypeError('Node type ${node.op} is not implemented');\n}\n};\n\nexport const CATEGORY = 'control';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under

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=====
*/n\nimport {Rank, Tensor, Tensor3D, Tensor4D, Tensor5D} from '@tensorflow/tfjs-core';n// tslint:disable-next-
line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport
{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from
'../executor/execution_context';\nimport {InternalOpExecutor, Node} from './types';\n\nimport {getPadding,
getParamValue} from './utils';\n\nfunction fusedConvAndDepthWiseParams(\n node: Node, tensorMap:
NamedTensorsMap, context: ExecutionContext) {\n const [extraOp, activationFunc] =\n (getParamValue('fusedOps', node, tensorMap, context) as string[]);\n\n const isBiasAdd
= extraOp === 'biasadd';\n const isPrelu = activationFunc === 'prelu';\n const isBatchNorm = extraOp ===
'fusedbatchnorm';\n\n const numArgs =\n (getParamValue('numArgs', node, tensorMap, context) as number);\n\n if (isBiasAdd) {\n if (isPrelu && numArgs !== 2) {\n throw new Error(\n 'FusedConv2d and
DepthwiseConv2d with BiasAdd and Prelu ' +\n 'must have two extra arguments: bias and alpha.');
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activationFunc as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n });\n }\n\n case 'FusedDepthwiseConv2dNative': {\n const {\n stride,\n pad,\n dataFormat,\n dilations,\n biasArg,\n preluArg,\n activationFunc,\n leakyreluAlpha,\n } = fusedConvAndDepthWiseParams(node, tensorMap, context);\n return\n [tfOps.fused.depthwiseConv2d({\n x: getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n filter: getParamValue('filter', node, tensorMap, context) as\n Tensor4D,\n strides: [stride[1], stride[2]],\n pad: pad as 'valid' | 'same',\n dataFormat: dataFormat as 'NHWC' | 'NCHW',\n dilations: [dilations[1], dilations[2]],\n bias: biasArg,\n activation: activationFunc\n as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n });\n }\n\n case 'Conv2DBackpropInput':\n case 'Conv2dTranspose': {\n const shape = getParamValue(\n 'outputShape', node, tensorMap,\n context) as [number, number, number] |\n [number, number, number, number];\n const stride =\n getParamValue('strides', node, tensorMap,\n context) as number[];\n const pad = getPadding(node, tensorMap, context);\n return\n [tfOps.conv2dTranspose(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n getParamValue('filter', node, tensorMap, context) as Tensor4D,\n shape, [stride[1],\n stride[2]], pad as 'valid' | 'same');\n]\n\n case 'DepthwiseConv2dNative':\n case 'DepthwiseConv2d': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getPadding(node,\n tensorMap, context);\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as\n number[];\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n .toUpperCase();\n return [tfOps.depthwiseConv2d(\n getParamValue('input', node,\n tensorMap, context) as Tensor3D |\n Tensor4D,\n getParamValue('filter', node, tensorMap,\n context) as Tensor4D,\n [stride[1], stride[2]], pad as 'valid' | 'same',\n dataFormat as 'NHWC' | 'NCHW', [dilations[1], dilations[2]]);\n]\n\n case 'Conv3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,\n tensorMap, context);\n const dataFormat\n =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n .toUpperCase();\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as number[];\n return\n [tfOps.conv3d(\n getParamValue('x', node, tensorMap, context) as Tensor4D |\n Tensor<Rank.R5>,\n getParamValue('filter', node, tensorMap, context) as\n Tensor<Rank.R5>,\n [stride[1], stride[2], stride[3]], pad as 'valid' | 'same',\n dataFormat as 'NDHWC' | 'NCDHW',\n [dilations[1], dilations[2], dilations[3]]);\n]\n\n case 'AvgPool': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,\n tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as\n number[];\n return\n [tfOps.avgPool(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n [kernelSize[1], kernelSize[2]], [stride[1], stride[2]],\n pad as 'valid' | 'same');\n]\n\n case\n 'MaxPool': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as\n number[];\n return [tfOps.maxPool(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n [kernelSize[1],\n kernelSize[2]], [stride[1], stride[2]],\n pad as 'valid' | 'same');\n]\n\n case 'MaxPoolWithArgmax':\n {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad\n =\n getParamValue('pad',\n node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap,\n context) as number[];\n const includeBatchInIndex =\n getParamValue('includeBatchInIndex', node,\n tensorMap, context) as\n boolean;\n const {result, indexes} = tfOps.maxPoolWithArgmax(\n getParamValue('x', node, tensorMap, context) as Tensor4D,\n [kernelSize[1], kernelSize[2]], [stride[1],

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stride[2]),\n pad as 'valid' | 'same', includeBatchInIndex);\n return [result, indexes];\n }\n case 'AvgPool3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as number[];\n return [tfOps.avgPool3d(\n getParamValue('x',\n node, tensorMap, context) as Tensor5D,\n [kernelSize[1], kernelSize[2], kernelSize[3]],\n [stride[1], stride[2], stride[3]], pad as 'valid' | 'same')];\n }\n case 'MaxPool3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad',\n node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap,\n context) as number[];\n return [tfOps.maxPool3d(\n getParamValue('x', node, tensorMap, context) as\n Tensor5D,\n [kernelSize[1], kernelSize[2], kernelSize[3]],\n [stride[1], stride[2], stride[3]], pad as\n 'valid' | 'same')];\n }\n case 'Dilation2D': {\n const strides =\n getParamValue('strides', node,\n tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const dilations\n =\n getParamValue('dilations', node, tensorMap, context) as number[];\n // strides: [1, stride_height,\n stride_width, 1].\n const strideHeight = strides[1];\n const strideWidth = strides[2];\n // dilations:\n [1, dilation_height, dilation_width, 1].\n const dilationHeight = dilations[1];\n const dilationWidth =\n dilations[2];\n return [tfOps.dilation2d(\n getParamValue('x', node, tensorMap, context) as Tensor3D\n |\n Tensor4D,\n getParamValue('filter', node, tensorMap, context) as Tensor3D,\n |\n [strideHeight, strideWidth], pad as 'valid' | 'same',\n [dilationHeight, dilationWidth], 'NHWC' /* dataFormat\n */);\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n};\n\nexport const CATEGORY = 'convolution';\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n * Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n\n*/\nimport {DataType, Tensor, Tensor1D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-\nfrom-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport\n{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from\n '../executor/execution_context';\nimport {InternalOpExecutor, Node}\n from './types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op)\n {\n case 'Fill': {\n const shape =\n getParamValue('shape', node, tensorMap, context) as\n number[];\n const dtype =\n getParamValue('dtype', node, tensorMap, context) as\n DataType;\n const value =\n getParamValue('value', node, tensorMap, context) as\n number;\n return\n [tfOps.fill(shape, value, dtype)];\n }\n case 'LinSpace': {\n const start =\n getParamValue('start', node, tensorMap, context) as\n number;\n const stop =\n getParamValue('stop',\n node, tensorMap, context) as number;\n const num = getParamValue('num', node, tensorMap, context) as\n number;\n return [tfOps.linspace(start, stop, num)];\n }\n case 'Multinomial': {\n const logits =\n getParamValue('logits', node, tensorMap, context) as\n Tensor1D;\n const numSamples =\n getParamValue('numSamples', node, tensorMap, context) as\n number;\n const seed =\n getParamValue('seed', node, tensorMap, context) as\n number;\n return\n [tfOps.multinomial(logits, numSamples, seed)];\n }\n case 'OneHot': {\n const indices =\n getParamValue('indices', node, tensorMap, context) as\n Tensor1D;\n const depth =\n
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getParamValue('depth', node, tensorMap, context) as number;\n const onValue =\n
getParamValue('onValue', node, tensorMap, context) as number;\n const offValue =\n
getParamValue('offValue', node, tensorMap, context) as number;\n return [tfOps.oneHot(indices, depth,\n
onValue, offValue)];\n }\n case 'Ones': {\n return [tfOps.ones(\n
 getParamValue('shape', node, tensorMap, context) as number[],\n getParamValue('dtype', node,\n
tensorMap, context) as DataType)];\n }\n case 'OnesLike': {\n return [tfOps.onesLike(\n
getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'RandomUniform': {\n return\n
[tfOps.randomUniform(\n // tslint:disable-next-line:no-any\n getParamValue('shape', node,\n
tensorMap, context) as any,\n getParamValue('minval', node, tensorMap, context) as number,\n
getParamValue('maxval', node, tensorMap, context) as number,\n getParamValue('dtype', node, tensorMap,\n
context) as DataType)];\n }\n case 'Range': {\n const start =\n getParamValue('start', node,\n
tensorMap, context) as number;\n const stop =\n getParamValue('stop', node, tensorMap, context) as\n
number;\n const step =\n
 getParamValue('step', node, tensorMap, context) as number;\n return [tfOps.range(\n start, stop,\n
step,\n getParamValue('dtype', node, tensorMap, context) as 'float32' |\n 'int32')];\n }\n case 'TruncatedNormal': {\n const shape =\n getParamValue('shape', node, tensorMap, context) as\n
number[];\n const mean =\n getParamValue('mean', node, tensorMap, context) as number;\n
const stdDev =\n getParamValue('stdDev', node, tensorMap, context) as number;\n const seed =\n
 getParamValue('seed', node, tensorMap, context) as number;\n return [tfOps.truncatedNormal(\n
shape, mean, stdDev,\n getParamValue('dtype', node, tensorMap, context) as 'float32' |\n 'int32',\n
 seed)];\n }\n case 'Zeros': {\n return [tfOps.zeros(\n getParamValue('shape', node,\n
tensorMap, context) as number[],\n getParamValue('dtype', node, tensorMap, context) as DataType)];\n
}\n case 'ZerosLike': {\n return [tfOps.zerosLike(\n getParamValue('x', node, tensorMap, context)\n
as Tensor)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n
};\n\nexport const CATEGORY = 'creation';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *

http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing\n
permissions and\n * limitations under the License.\n *

=====
*\n\nimport {Tensor, Tensor1D, Tensor2D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-\n
from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport\n
{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from\n
'../executor/execution_context';\nimport {InternalOpAsyncExecutor, Node} from '../types';\nimport\n
{getParamValue} from './utils';\n\nfunction nmsParams(\n node: Node, tensorMap: NamedTensorsMap, context:\n
ExecutionContext) {\n const boxes = getParamValue('boxes', node, tensorMap, context) as Tensor;\n const scores\n
= getParamValue('scores', node, tensorMap, context) as Tensor;\n const maxOutputSize =\n
getParamValue('maxOutputSize', node, tensorMap, context) as number;\n const iouThreshold =\n
getParamValue('iouThreshold', node, tensorMap, context)\n
as number;\n const scoreThreshold =\n getParamValue('scoreThreshold', node, tensorMap, context) as\n
number;\n const softNmsSigma =\n getParamValue('softNmsSigma', node, tensorMap, context) as number;\n
\n return {\n boxes,\n scores,\n maxOutputSize,\n iouThreshold,\n scoreThreshold,\n softNmsSigma\n
};\n}\n\nexport const executeOp: InternalOpAsyncExecutor = async(\n node: Node, tensorMap:\n
NamedTensorsMap,\n context: ExecutionContext): Promise<Tensor[]> => {\n switch (node.op) {\n case\n
'NonMaxSuppressionV5': {\n const {\n boxes,\n scores,\n maxOutputSize,\n iouThreshold,\n

```

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scoreThreshold,\n softNmsSigma\n } = nmsParams(node, tensorMap, context);\n\n const result = await
tfOps.image.nonMaxSuppressionWithScoreAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize,
iouThreshold,\n scoreThreshold, softNmsSigma);\n\n return [result.selectedIndices,
result.selectedScores];\n
 }\n case 'NonMaxSuppressionV4': {\n const { boxes, scores, maxOutputSize, iouThreshold, scoreThreshold }
=\n nmsParams(node, tensorMap, context);\n\n const padToMaxOutputSize =\n getParamValue('padToMaxOutputSize', node, tensorMap, context) as\n boolean;\n\n const result = await
tfOps.image.nonMaxSuppressionPaddedAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize,
iouThreshold,\n scoreThreshold, padToMaxOutputSize);\n\n return [result.selectedIndices,
result.validOutputs];\n }\n case 'NonMaxSuppressionV3':\n case 'NonMaxSuppressionV2': {\n const
{ boxes, scores, maxOutputSize, iouThreshold, scoreThreshold } =\n nmsParams(node, tensorMap,
context);\n\n return [await tfOps.image.nonMaxSuppressionAsync(\n boxes as Tensor2D, scores as
Tensor1D, maxOutputSize, iouThreshold,\n scoreThreshold)];\n }\n case 'Where': {\n const condition =
tfOps.cast(\n (getParamValue('condition', node, tensorMap, context) as Tensor),\n 'bool');\n const result = [await
tfOps.whereAsync(condition)];\n condition.dispose();\n return result;\n }\n case 'ListDiff': {\n return
tfOps.setdiff1dAsync(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('y',
node, tensorMap, context) as Tensor);\n }\n default:\n throw TypeError(`Node type ${node.op} is not
implemented`);\n }\n};\n\nexport const CATEGORY = 'dynamic';\n\n"/**\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { Tensor } from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as
tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport { NamedTensorsMap } from
'../data/types';\nimport { ExecutionContext } from '../executor/execution_context';\nimport { InternalOpExecutor,
Node } from '../types';\nimport { getParamValue } from './utils';\n\nexport const executeOp: InternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext):\n Tensor[] => {\n switch
(node.op) {\n case 'TopKV2': {\n const x = getParamValue('x', node, tensorMap, context) as
Tensor;\n const k = getParamValue('k', node, tensorMap,
context) as number;\n const sorted =\n getParamValue('sorted', node, tensorMap, context) as
boolean;\n const result = tfOps.topk(x, k, sorted);\n return [result.values, result.indices];\n }\n case 'Unique': {\n const x = getParamValue('x', node, tensorMap, context) as Tensor;\n const
result = tfOps.unique(x);\n return [result.values, result.indices];\n }\n case 'UniqueV2': {\n const x = getParamValue('x', node, tensorMap, context) as Tensor;\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const result = tfOps.unique(x, axis);\n return [result.values, result.indices];\n }\n default:\n throw TypeError(`Node type ${node.op}
is not implemented`);\n }\n }\n};\n\nexport const CATEGORY = 'evaluation';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n

```

```

*\n\nimport { Tensor } from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as
tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport { NamedTensorsMap } from
'../../data/types';\nimport { ExecutionContext } from '../../executor/execution_context';\nimport
{ InternalOpExecutor, Node } from './types';\nimport { cloneTensor, getParamValue, getTensor } from
'./utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'Const': {\n return
tensorMap[node.name];\n }\n case 'PlaceholderWithDefault':\n const def =\n getParamValue('default', node, tensorMap, context) as Tensor;\n return [getTensor(node.name, tensorMap,\n context) || def];\n case 'Placeholder':\n return [getTensor(node.name, tensorMap, context)];\n case
'Identity':\n case 'StopGradient':\n case 'FakeQuantWithMinMaxVars': { // This op is currently ignored.\n const data = getParamValue('x', node, tensorMap, context) as Tensor;\n return [cloneTensor(data)];\n }\n case 'IdentityN':\n return (getParamValue('x',\n node, tensorMap, context) as Tensor[])\n .map((t: Tensor) => cloneTensor(t));\n case 'Snapshot':\n const snapshot =\n (getParamValue('x', node, tensorMap, context) as Tensor);\n return
[cloneTensor(snapshot)];\n case 'Shape':\n return [tfOps.tensor1d(\n (getParamValue('x', node,\n tensorMap, context) as Tensor).shape,\n 'int32')];\n case 'ShapeN':\n return (getParamValue('x',\n node, tensorMap, context) as Tensor[])\n .map((t: Tensor) => tfOps.tensor1d(t.shape));\n case 'Size':\n return [tfOps.scalar(\n (getParamValue('x', node, tensorMap, context) as Tensor).size,\n 'int32')];\n case 'Rank':\n return [tfOps.scalar(\n (getParamValue('x', node, tensorMap, context) as
Tensor).rank,\n 'int32')];\n case 'NoOp':\n return [tfOps.scalar(1)];\n case 'Print':\n const input = getParamValue('x', node, tensorMap, context) as Tensor;\n const data =\n getParamValue('data', node, tensorMap, context) as Tensor[];\n const message =\n getParamValue('message', node, tensorMap, context) as string;\n const summarize =\n getParamValue('summarize', node, tensorMap, context) as number;\n console.warn(\n 'The graph has a\n tf.print() operation, ' +\n 'usually used for debugging, which slows down performance.);\n console.log(message);\n for (let i = 0; i < data.length; i++) {\n console.log(Array.prototype.slice.call(data[i].dataSync())\n .slice(0, summarize));\n }\n return [input];\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const CATEGORY = 'graph';\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

=====
*\n\nimport { DataType, keep, scalar, stack, Tensor, tidy, unstack, util } from '@tensorflow/tfjs-core';\n\n/**\n *
HashTable contains a set of tensors, which can be accessed by key.\n\nexport class HashTable {\n readonly
handle: Tensor;\n // tslint:disable-next-line: no-any\n private tensorMap: Map<any, Tensor>;\n get id() {\n
 return this.handle.id;\n }\n /**\n * Constructor of HashTable. Creates a hash table.\n * @param
keyDType `dtype` of the table keys.\n * @param valueDType `dtype` of the table values.\n *

constructor(readonly keyDType: DataType, readonly valueDType: DataType) {\n this.handle = scalar(0);\n //
tslint:disable-next-line: no-any\n this.tensorMap = new Map<any, Tensor>();\n keep(this.handle);\n }\n\n
/**\n * Dispose the tensors and handle and clear the hashtable.\n *

clearAndClose() {\n this.tensorMap.forEach(value => value.dispose());\n this.tensorMap.clear();\n this.handle.dispose();\n }\n\n
/**\n * The number of items in the hash table.\n *

size(): number {\n return this.tensorMap.size;\n }\n\n
/**\n * Replaces the contents of the table with the specified keys and values.\n * @param keys Keys to store in
the hashtable.\n * @param values Values to store in the hashtable.\n *

async import(keys: Tensor, values:

```

```

Tensor): Promise<Tensor> {\n this.checkKeyAndValueTensor(keys, values);\n\n // We only store the primitive
values of the keys, this allows lookup\n // to be O(1).\n const $keys = await keys.data();\n\n // Clear the
hashTable before inserting new values.\n this.tensorMap.forEach(value => value.dispose());\n
this.tensorMap.clear();\n\n return tidy(() => {\n const $values = unstack(values);\n\n const keysLength =
$keys.length;\n const valuesLength = $values.length;\n\n util.assert(\n keysLength === valuesLength,\n
 () => `The number of elements doesn't match, keys has ` +\n `${keysLength} elements, the values has
${valuesLength} ` +\n `elements.`);\n\n for (let i = 0; i < keysLength; i++) {\n const key =
$keys[i];\n const value = $values[i];\n keep(value);\n this.tensorMap.set(key, value);\n }\n\n
return this.handle;\n });\n}\n\n/**\n * Looks up
keys in a hash table, outputs the corresponding values.\n * \n * Performs batch lookups, for every element in the
key tensor, `find`\n * stacks the corresponding value into the return tensor.\n * \n * If an element is not present in
the table, the given `defaultValue` is\n * used.\n * \n * @param keys Keys to look up. Must have the same type
as the keys of the\n * table.\n * @param defaultValue The scalar `defaultValue` is the value output for keys\n
* not present in the table. It must also be of the same type as the\n * table values.\n */\n async find(keys:
Tensor, defaultValue: Tensor): Promise<Tensor> {\n this.checkKeyAndValueTensor(keys, defaultValue);\n\n const $keys = await keys.data();\n\n return tidy(() => {\n const result: Tensor[] = [];\n\n for (let i = 0; i <
$keys.length; i++) {\n const key = $keys[i];\n\n const value = this.findWithDefault(key, defaultValue);\n
 result.push(value);\n }\n\n return stack(result);\n });\n}\n\n// tslint:disable-next-line: no-any\n private findWithDefault(key: any,
defaultValue: Tensor): Tensor {\n const result = this.tensorMap.get(key);\n return result != null ? result :
defaultValue;\n}\n\n private checkKeyAndValueTensor(key: Tensor, value: Tensor) {\n if (key.dtype !==
this.keyDType) {\n throw new Error(\n `Expect key dtype ${this.keyDType}, but got ` +\n
`${key.dtype}`);\n }\n\n if (value.dtype !== this.valueDType) {\n throw new Error(\n `Expect value
dtype ${this.valueDType}, but got ` +\n `${value.dtype}`);\n }\n}\n}\n\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
* http://www.apache.org/licenses/LICENSE-2.0\n *\n
* Unless required by applicable law
or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n
=====*\n
*/\n\nimport {DataType, Tensor} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from
'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {HashTable} from
'../executor/hash_table';\nimport {ResourceManager} from '../executor/resource_manager';\nimport
{InternalOpAsyncExecutor, Node} from './types';\n\nimport {getParamValue} from './utils';\n\nexport const
executeOp: InternalOpAsyncExecutor = async(\n node: Node, tensorMap: NamedTensorsMap, context:
ExecutionContext,\n resourceManager: ResourceManager): Promise<Tensor[]> => {\n switch (node.op) {\n
case 'HashTable':\n case 'HashTableV2': {\n const keyDType =\n getParamValue('keyDType', node,
tensorMap, context) as DataType;\n const valueDType =\n getParamValue('valueDType', node, tensorMap,
context) as DataType;\n\n const hashTable = new HashTable(keyDType, valueDType);\n
resourceManager.addHashTable(node.name, hashTable);\n return [hashTable.handle];\n }\n case
'LookupTableImport':\n case 'LookupTableImportV2': {\n const handle = getParamValue(\n
'tableHandle', node, tensorMap, context,\n resourceManager) as Tensor;\n const keys =
getParamValue('keys', node, tensorMap, context) as Tensor;\n const values =\n getParamValue('values',
node, tensorMap, context) as Tensor;\n\n const hashTable = resourceManager.getHashTableById(handle.id);\n
return [await hashTable.import(keys, values)];\n }\n case 'LookupTableFind':\n case 'LookupTableFindV2':
{\n const handle = getParamValue(\n 'tableHandle', node, tensorMap, context,\n resourceManager) as Tensor;\n const keys = getParamValue('keys', node, tensorMap, context) as Tensor;\n
}

```

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const defaultValue = \n getParamValue('defaultValue', node, tensorMap, context) as Tensor;\n\n const
hashTable = resourceManager.getHashTableById(handle.id);\n return [await hashTable.find(keys,
defaultValue)];\n } \n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n
}\n};\n\nexport const CATEGORY = 'hash_table';\n", "/**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D} from '@tensorflow/tfjs-core';\n// tslint:disable-
next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from '../data/types';\nimport
{ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from
../types;\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor = \n (node:
Node, tensorMap: NamedTensorsMap, \n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n
case 'ResizeBilinear': {\n const images
=\n getParamValue('images', node, tensorMap, context) as Tensor;\n const size = \n
getParamValue('size', node, tensorMap, context) as number[];\n const alignCorners = \n
getParamValue('alignCorners', node, tensorMap, context) as\n boolean;\n const halfPixelCenters = \n
getParamValue('halfPixelCenters', node, tensorMap, context) as\n boolean;\n return
[tfOps.image.resizeBilinear(\n images as Tensor3D | Tensor4D, [size[0], size[1]], alignCorners, \n
halfPixelCenters)];\n } \n case 'ResizeNearestNeighbor': {\n const images = \n
getParamValue('images', node, tensorMap, context) as Tensor;\n const size = \n
getParamValue('size',
node, tensorMap, context) as number[];\n const alignCorners = \n
getParamValue('alignCorners', node,
tensorMap, context) as\n boolean;\n
 const halfPixelCenters = \n
getParamValue('halfPixelCenters', node, tensorMap, context) as\n
boolean;\n return [tfOps.image.resizeNearestNeighbor(\n images as Tensor3D | Tensor4D, [size[0],
size[1]], alignCorners, \n halfPixelCenters)];\n } \n case 'CropAndResize': {\n const image = \n
getParamValue('image', node, tensorMap, context) as Tensor;\n const boxes = \n
getParamValue('boxes', node, tensorMap, context) as Tensor;\n const boxInd = \n
getParamValue('boxInd', node, tensorMap, context) as Tensor;\n const cropSize = \n
getParamValue('cropSize', node, tensorMap, context) as number[];\n const method = \n
getParamValue('method', node, tensorMap, context) as string;\n const extrapolationValue = \n
getParamValue('extrapolationValue', node, tensorMap, context) as\n number;\n
 return [tfOps.image.cropAndResize(\n image as Tensor4D, boxes as Tensor2D, boxInd as Tensor1D, \n
cropSize as [number, number], method as 'bilinear' | 'nearest', \n extrapolationValue)];\n } \n
default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n } \n }; \n\nexport const
CATEGORY = 'image';\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
===== \n

```

```

*\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as
tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from
'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor,
Node} from '../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch
(node.op) {\n case 'Equal': {\n return [tfOps.equal(\n getParamValue('a', node, tensorMap,
context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case
'NotEqual': {\n return [tfOps.notEqual(\n getParamValue('a', node, tensorMap, context)
as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Greater': {\n
return [tfOps.greater(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'GreaterEqual': {\n return
[tfOps.greaterEqual(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Less': {\n return [tfOps.less(\n
 getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap,
context) as Tensor)];\n }\n case 'LessEqual': {\n return [tfOps.lessEqual(\n
 getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'LogicalAnd':\n {\n return [tfOps.logicalAnd(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'LogicalNot': {\n return
[tfOps.logicalNot(\n getParamValue('a', node, tensorMap, context) as Tensor)];\n }\n case
'LogicalOr': {\n return [tfOps.logicalOr(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Select':\n case 'SelectV2':\n {\n return [tfOps.where(\n getParamValue('condition', node, tensorMap, context) as Tensor,\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n }\n };\n\nexport const

```

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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n\nimport {Tensor, Tensor2D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-
dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap}
from '../data/types';\nimport
{ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from
'../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node:
Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n
case 'BatchMatMul':\n case 'BatchMatMulV2':\n case 'MatMul':\n return [tfOps.matMul(\n
 getParamValue('a', node, tensorMap, context) as Tensor2D,\n getParamValue('b', node, tensorMap, context)
as Tensor2D,\n getParamValue('transposeA', node, tensorMap, context) as boolean,\n getParamValue('transposeB', node, tensorMap, context) as\n boolean)];\n case 'Transpose':\n return [tfOps.transpose(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('perm', node, tensorMap, context) as number[])];\n case '_FusedMatMul':\n const [extraOp, activationFunc] =\n (getParamValue('fusedOps', node, tensorMap, context) as\n string[]);\n const isBiasAdd = extraOp === 'biasadd';\n const isPrelu = activationFunc === 'prelu';\n

```

```

const numArgs =\n (getParamValue('numArgs', node, tensorMap, context) as number);\n const\nleakyreluAlpha =\n getParamValue('leakyreluAlpha', node, tensorMap, context) as\n number;\n if (isBiasAdd) {\n if (isPrelu && numArgs !== 2) {\n throw new Error(\n 'Fused\nMatMul with BiasAdd and Prelu must have two '+\n 'extra arguments: bias and alpha.);\n }\n if (!isPrelu && numArgs !== 1) {\n throw new Error(\n 'Fused MatMul with BiasAdd must\nhave one extra argument: bias.);\n }\n }\n const [biasArg, preluArg] =\n getParamValue('args',\n node, tensorMap, context) as Tensor[];\n return [tfOps.fused.matMul({\n a: getParamValue('a', node,\ntensorMap, context) as Tensor2D,\n b: getParamValue('b', node, tensorMap, context) as Tensor2D,\n transposeA: getParamValue('transposeA', node, tensorMap, context) as\n boolean,\n transposeB:\n getParamValue('transposeB', node, tensorMap, context) as\n boolean,\n bias: biasArg,\n activation: activationFunc as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n })];\n default:\n throw TypeError(`Node type ${node.op} is not\nimplemented`);\n }\n };\n export const CATEGORY = 'matrices';\n /**\n * @license\n * Copyright 2018\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\n import {Scalar, Tensor, Tensor3D, Tensor4D} from '@tensorflow/tfjs-core';\n tslint:disable-next-line: no-\n imports-from-dist\n import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n import\n {NamedTensorsMap} from '../data/types';\n import {ExecutionContext} from\n '../executor/execution_context';\n import {InternalOpExecutor, Node} from '../types';\n import {getParamValue}\n from './utils';\n export const executeOp: InternalOpExecutor =\n (node: Node, tensorMap:\n NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case\n 'FusedBatchNorm':\n case 'FusedBatchNormV2': {\n return [tfOps.batchNorm(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('mean', node, tensorMap,\n context) as Tensor,\n getParamValue('variance', node, tensorMap, context) as Tensor,\n getParamValue('offset', node, tensorMap, context) as Tensor,\n getParamValue('scale', node, tensorMap,\n context) as Tensor,\n getParamValue('epsilon', node, tensorMap, context) as number)];\n }\n case\n 'FusedBatchNormV3': {\n return [tfOps.batchNorm(\n getParamValue('x', node, tensorMap, context)\n as Tensor,\n getParamValue('mean', node, tensorMap, context) as Tensor,\n getParamValue('variance', node, tensorMap, context) as Tensor,\n getParamValue('offset',\n node, tensorMap, context) as Tensor,\n getParamValue('scale', node, tensorMap, context) as Tensor,\n getParamValue('epsilon', node, tensorMap, context) as number)];\n }\n case 'LRN': {\n return\n [tfOps.localResponseNormalization(\n getParamValue('x', node, tensorMap, context) as Tensor3D | \n Tensor4D,\n getParamValue('radius', node, tensorMap, context) as number,\n getParamValue('bias', node, tensorMap, context) as number,\n getParamValue('alpha', node, tensorMap,\n context) as number,\n getParamValue('beta', node, tensorMap, context) as number)];\n }\n case\n 'Softmax': {\n return [tfOps.softmax(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'LogSoftmax': {\n return [tfOps.logSoftmax(\n getParamValue('x', node, tensorMap,\n context) as Tensor)];\n }\n case\n 'SparseToDense': {\n return [tfOps.sparseToDense(\n getParamValue('sparseIndices', node,\ntensorMap, context) as\n Tensor,\n getParamValue('outputShape', node, tensorMap, context) as\n Tensor,\n getParamValue('sparseValues', node, tensorMap, context) as\n number[],\n getParamValue('defaultValue', node, tensorMap, context) as\n Scalar)];\n }\n default:\n
```



```

throw TypeError(`Node type ${node.op} is not implemented`);
}
};
export const CATEGORY =
'normalization';
/**
 * @license
 * Copyright 2018 Google LLC. All Rights Reserved.
 * Licensed under the
 Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the
 License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR
 CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing
 permissions and
 limitations under the License.

```

```

=====
import {Tensor, Tensor1D, Tensor2D} from '@tensorflow/tfjs-core';
// tslint:disable-next-line: no-imports-
from-dist
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';
import
{NamedTensorsMap} from '../data/types';
import {ExecutionContext} from
 '../executor/execution_context';
import {InternalOpExecutor, Node} from './types';
import {getParamValue}
from './utils';
export const executeOp: InternalOpExecutor =
(node: Node, tensorMap: NamedTensorsMap,
context: ExecutionContext): Tensor[] => {
 switch (node.op) {
 case 'Max': {
 const axis =
 getParamValue('axis',
node, tensorMap, context) as number[];
 const keepDims =
 getParamValue('keepDims', node,
tensorMap, context) as boolean;
 return [tfOps.max(
 getParamValue('x', node, tensorMap, context)
as Tensor, axis,
keepDims)];
 }
 case 'Mean': {
 const axis =
 getParamValue('axis', node, tensorMap, context) as number[];
 const keepDims =
 getParamValue('keepDims', node, tensorMap, context) as boolean;
 return [tfOps.mean(
 getParamValue('x', node, tensorMap, context) as Tensor, axis,
keepDims)];
 }
 case 'Min': {
 const axis =
 getParamValue('axis', node, tensorMap, context) as number[];
 const keepDims =
 getParamValue('keepDims', node, tensorMap, context) as boolean;
 return [tfOps.min(
 getParamValue('x', node, tensorMap, context) as Tensor,
axis,
keepDims)];
 }
 case 'Sum': {
 const axis =
 getParamValue('axis', node,
tensorMap, context) as number[];
 const keepDims =
 getParamValue('keepDims', node, tensorMap,
context) as boolean;
 return [tfOps.sum(
 getParamValue('x', node, tensorMap, context) as Tensor,
axis,
keepDims)];
 }
 case 'All': {
 const axis =
 getParamValue('axis', node,
tensorMap, context) as number[];
 const keepDims =
 getParamValue('keepDims', node, tensorMap,
context) as boolean;
 return [tfOps.all(
 getParamValue('x', node, tensorMap, context) as Tensor,
axis,
keepDims)];
 }
 case 'Any': {
 const axis =
 getParamValue('axis', node,
tensorMap, context) as number[];
 const keepDims =
 getParamValue('keepDims', node, tensorMap,
context) as boolean;
 return [tfOps.any(
 getParamValue('x', node, tensorMap, context) as Tensor,
axis,
keepDims)];
 }
 case 'ArgMax': {
 const axis =
 getParamValue('axis',
node, tensorMap, context) as number;
 return [tfOps.argMax(
 getParamValue('x', node, tensorMap,
context) as Tensor, axis)];
 }
 case 'ArgMin': {
 const axis =
 getParamValue('axis', node,
tensorMap, context) as number;
 return [tfOps.argMin(
 getParamValue('x', node, tensorMap,
context) as Tensor, axis)];
 }
 case 'Prod': {
 const axis =
 getParamValue('axis', node,
tensorMap, context) as number[];
 const keepDims =
 getParamValue('keepDims', node, tensorMap,
context) as boolean;
 return [tfOps.prod(
 getParamValue('x', node, tensorMap, context) as Tensor,
axis,
keepDims)];
 }
 case 'Cumsum': {
 const axis =
 getParamValue('axis', node,
tensorMap, context) as number;
 const exclusive =
 getParamValue('exclusive', node, tensorMap,
context) as boolean;
 const reverse =
 getParamValue('reverse', node, tensorMap, context) as
boolean;
 return [tfOps.cumsum(
 getParamValue('x', node, tensorMap, context) as Tensor, axis,
exclusive, reverse)];
 }
 case 'Bincount': {
 const x = getParamValue('x', node, tensorMap,
context) as Tensor1D;
 const weights =
 getParamValue('weights', node, tensorMap, context) as

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Tensor1D;\n const size =\n getParamValue('size', node, tensorMap, context) as number;\n\nreturn [tfOps.bincount(x, weights, size)];\n case 'DenseBincount': {\n const x = getParamValue('x', node,\ntensorMap, context)\n as Tensor1D |\n Tensor2D;\n const weights =\n getParamValue('weights', node, tensorMap,\ncontext) as Tensor1D |\n Tensor2D;\n const size =\n getParamValue('size', node, tensorMap,\ncontext) as number;\n\n const binaryOutput =\n getParamValue('binaryOutput', node, tensorMap,\ncontext) as\n boolean;\n\n return [tfOps.denseBincount(x, weights, size, binaryOutput)];\n }\n\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\n\nexport const\nCATEGORY = 'reduction';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Scalar, Tensor, Tensor1D, tidy, util} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-
imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport\n{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from\n'../executor/execution_context';\nimport {InternalOpExecutor, Node} from './types';\nimport {getParamValue}\nfrom './utils';\n\nexport const executeOp: InternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap,\ncontext: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'ConcatV2':\n case 'Concat': {\n const n = getParamValue('n', node, tensorMap, context) as number;\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n let inputs =\n getParamValue('tensors',\nnode, tensorMap, context) as Tensor[];\n inputs = inputs.slice(0, n);\n return [tfOps.concat(inputs,\naxis)];\n }\n case 'Gather': {\n const input = getParamValue('x', node, tensorMap, context) as\nTensor;\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor1D;\n return [tfOps.gather(input, tfOps.cast(indices, 'int32'), 0)];\n }\n case 'GatherV2': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const batchDims =\n getParamValue('batchDims', node, tensorMap, context) as number;\n const input = getParamValue('x', node,\ntensorMap, context) as Tensor;\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor1D;\n return\n[tfOps.gather(\n input, tfOps.cast(indices, 'int32'), axis, batchDims)];\n }\n case 'Reverse': {\n const dims =\n getParamValue('dims', node, tensorMap, context) as boolean[];\n const axis = [];\n for (let i = 0; i < dims.length; i++) {\n if (dims[i]) {\n axis.push(i);\n }\n }\n const\ninput = getParamValue('x', node, tensorMap, context) as Tensor;\n return [tfOps.reverse(input, axis)];\n }\n case 'ReverseV2': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as\nnumber[];\n const input = getParamValue('x', node, tensorMap, context) as Tensor;\n return\n[tfOps.reverse(input, axis)];\n }\n case 'Slice': {\n // tslint:disable-next-line:no-any\n const\nbegin = getParamValue('begin', node, tensorMap, context) as any;\n // tslint:disable-next-line:no-any\n const size = getParamValue('size', node, tensorMap, context) as any;\n return [tfOps.slice(\n getParamValue('x', node, tensorMap, context) as Tensor, begin,\n size)];\n }\n case 'StridedSlice':\n {\n const begin =\n getParamValue('begin', node, tensorMap, context) as number[];\n const end\n =\n getParamValue('end', node, tensorMap, context) as number[];\n const strides =\n getParamValue('strides', node, tensorMap, context) as number[];\n const beginMask =\n getParamValue('beginMask', node, tensorMap, context) as number;\n const endMask =\n getParamValue('endMask', node, tensorMap, context) as number;\n const ellipsisMask =\n getParamValue('ellipsisMask', node, tensorMap, context) as number;\n
```



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[tfOps.fft(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'IFFT':
{\n return [tfOps.ifft(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'RFFT': {\n return [tfOps.rfft(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n }\n case 'IRFFT': {\n return [tfOps.irfft(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n
};\n\nexport const CATEGORY = 'spectral';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor, Tensor4D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-
dist\nimport
* as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from
'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor,
Node} from '../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch
(node.op) {\n case 'Cast': {\n return [tfOps.cast(\n getParamValue('x', node, tensorMap, context)
as Tensor,\n getParamValue('dtype', node, tensorMap, context) as 'int32' |\n 'float32' | 'bool')];\n
}\n case 'ExpandDims': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as
number;\n return [tfOps.expandDims(\n getParamValue('x', node, tensorMap, context) as Tensor,
axis)];\n }\n case 'Squeeze': {\n
const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n return
[tfOps.squeeze(\n getParamValue('x', node, tensorMap, context) as Tensor, axis)];\n }\n\n case
'Reshape': {\n return [tfOps.reshape(\n getParamValue('x', node, tensorMap, context) as Tensor,\n
getParamValue('shape', node, tensorMap, context) as number[])];\n }\n case 'MirrorPad': {\n return
[tfOps.mirrorPad(\n getParamValue('x', node, tensorMap, context) as Tensor,\n
getParamValue('padding', node, tensorMap, context) as\n Array<[number, number]>,\n
getParamValue('mode', node, tensorMap, context) as 'reflect' |\n 'symmetric')];\n }\n case
'PadV2':\n case 'Pad': {\n return [tfOps.pad(\n getParamValue('x', node, tensorMap, context) as
Tensor,\n getParamValue('padding',
node, tensorMap, context) as\n Array<[number, number]>,\n getParamValue('constantValue',
node, tensorMap, context) as\n number)];\n }\n case 'SpaceToBatchND': {\n const
blockShape =\n getParamValue('blockShape', node, tensorMap, context) as number[];\n const
paddings =\n getParamValue('paddings', node, tensorMap, context) as number[][];\n return
[tfOps.spaceToBatchND(\n getParamValue('x', node, tensorMap, context) as Tensor,\n blockShape,
paddings)];\n }\n case 'BatchToSpaceND': {\n const blockShape =\n
getParamValue('blockShape', node, tensorMap, context) as number[];\n const crops =\n
getParamValue('crops', node, tensorMap, context) as number[][];\n return [tfOps.batchToSpaceND(\n
getParamValue('x', node, tensorMap, context) as Tensor,\n blockShape,
crops)];\n }\n case 'DepthToSpace': {\n const blockSize =\n
getParamValue('blockSize',
node, tensorMap, context) as number;\n const dataFormat =\n (getParamValue('dataFormat', node,
tensorMap, context) as\n string).toUpperCase() as 'NHWC' |\n 'NCHW';\n return
[tfOps.depthToSpace(\n getParamValue('x', node, tensorMap, context) as Tensor4D,\n blockSize,
dataFormat)];\n }\n case 'BroadcastTo': {\n return [tfOps.broadcastTo(\n
getParamValue('x',

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node, tensorMap, context) as Tensor,\n getParamValue('shape', node, tensorMap, context) as number[]]);\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n};\n\nexport\nconst CATEGORY = 'transformation';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport * as tfc from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from './data/types';\nimport {ExecutionContext} from './executor/execution_context';\nimport {ResourceManager} from\n './executor/resource_manager';\nimport {NodeValueImpl} from './custom_op/node_value_impl';\nimport {getRegisteredOp} from './custom_op/register';\nimport * as arithmetic from\n './executors/arithmetic_executor';\nimport\n * as basicMath from './executors/basic_math_executor';\nimport * as control from\n './executors/control_executor';\nimport * as convolution from './executors/convolution_executor';\nimport * as\n creation from './executors/creation_executor';\nimport * as dynamic from './executors/dynamic_executor';\nimport * as\n evaluation from './executors/evaluation_executor';\nimport * as graph from './executors/graph_executor';\nimport *\n as hashTable from './executors/hash_table_executor';\nimport * as image from\n './executors/image_executor';\nimport * as logical from './executors/logical_executor';\nimport * as matrices from\n './executors/matrices_executor';\nimport * as normalization from './executors/normalization_executor';\nimport * as\n reduction from './executors/reduction_executor';\nimport * as sliceJoin from\n './executors/slice_join_executor';\nimport * as spectral from './executors/spectral_executor';\nimport * as\n transformation from './executors/transformation_executor';\nimport\n {Node} from './types';\n\n/**\n * Executes the op defined by the node object.\n * @param node\n * @param\n tensorMap contains tensors for executed nodes and weights\n * @param context contains tensors and information\n for running the current node.\n * @param resourceManager Optional. Contains global resources of the model.\n */\n\nexport function executeOp(\n node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext,\n resourceManager?: ResourceManager): tfc.Tensor[]|Promise<tfc.Tensor[]> {\n const value =\n ((node: Node,\n tensorMap: NamedTensorsMap, context: ExecutionContext) => {\n switch (node.category) {\n case\n 'arithmetic':\n return tfc.tidy(\n () => arithmetic.executeOp(node, tensorMap, context));\n case\n 'basic_math':\n return tfc.tidy(\n () => basicMath.executeOp(node, tensorMap, context));\n case\n 'control':\n return control.executeOp(node, tensorMap, context);\n case\n 'convolution':\n return tfc.tidy(\n () => convolution.executeOp(node, tensorMap,\n context));\n case\n 'creation':\n return tfc.tidy(() => creation.executeOp(node, tensorMap, context));\n case\n 'dynamic':\n return dynamic.executeOp(node, tensorMap, context);\n case\n 'evaluation':\n return tfc.tidy(\n () => evaluation.executeOp(node, tensorMap, context));\n case\n 'image':\n return tfc.tidy(() => image.executeOp(node, tensorMap, context));\n case\n 'graph':\n return tfc.tidy(() =>\n graph.executeOp(node, tensorMap, context));\n case\n 'logical':\n return tfc.tidy(() =>\n logical.executeOp(node, tensorMap, context));\n case\n 'matrices':\n return tfc.tidy(() =>\n matrices.executeOp(node, tensorMap, context));\n case\n 'normalization':\n return tfc.tidy(\n ()\n => normalization.executeOp(node,\n tensorMap, context));\n case\n 'reduction':\n return tfc.tidy(\n () => reduction.executeOp(node,\n tensorMap, context));\n case\n 'slice_join':\n return tfc.tidy(\n () => sliceJoin.executeOp(node,\n tensorMap, context));\n case\n 'spectral':\n return tfc.tidy(() => spectral.executeOp(node, tensorMap,\n context));\n case\n 'transformation':\n return tfc.tidy(\n () => transformation.executeOp(node,\n tensorMap, context));\n case\n 'hash_table':\n return hashTable.executeOp(\n node, tensorMap,

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```

context, resourceManager);\n case 'custom':\n const opMapper = getRegisteredOp(node.op);\n if (opMapper && opMapper.customExecutor) {\n return opMapper.customExecutor(\n new\n NodeValueImpl(node, tensorMap, context));\n } else {\n throw TypeError(`Custom op ${node.op}\n is not registered.`);\n }\n default:\n throw TypeError(\n `Unknown op '${node.op}'.\n File an issue at ` +\n `https://github.com/tensorflow/tfjs/issues so we can add it` +\n `, or register a\n custom execution with tf.registerOp()`);\n }\n })(node, tensorMap, context);\n if (tfc.util.isPromise(value))\n {\n return (value as Promise<tfc.Tensor>).then((data) => [].concat(data));\n }\n return\n [].concat(value);\n }\n \"/>**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY\n KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
 =====\n *\n * @import {Tensor} from '@tensorflow/tfjs-core';\n * import {NamedTensorsMap, TensorArrayMap,\n * TensorListMap} from './data/types';\n * import {TensorArray} from './tensor_array';\n * import {TensorList} from\n './tensor_list';\n * import {FunctionExecutor} from './types';\n * export interface ExecutionContextInfo {\n * id: number;\n * // the unique id of the context info\n * frameName: string; // The frame name of the loop, this comes from\n * // the TensorFlow NodeDef.\n * iterationId: number; // The iteration id of the loop\n * }\n * /**\n * ExecutionContext captures the runtime environment of the node. It keeps\n * track of the current frame and iteration\n * for the control flow ops.\n * For example, typical Dynamic RNN model may contain loops, for\n * which\n * TensorFlow will generate graphs with Enter/Exit nodes to control the\n * current execution frame, and\n * NextIteration Nodes for iteration id increment.\n * For model with branch logic, TensorFlow will generate\n * Switch/Merge ops.\n * export class ExecutionContext {\n * private rootContext = {id: 0, frameName: '', iterationId:\n * 0};\n * private contexts: ExecutionContextInfo[] = [this.rootContext];\n * private lastId = 0;\n * private\n * _currentContextIds: string[];\n * constructor(\n * readonly weightMap: NamedTensorsMap = {},\n * readonly\n * tensorArrayMap: TensorArrayMap = {},\n * readonly tensorListMap: TensorListMap = {},\n * readonly\n * functionMap: {[key: string]: FunctionExecutor} = {}) {\n * this.generateCurrentContextIds();\n * }\n * private\n * newFrame(id: number, frameName: string) {\n * return {id, frameName, iterationId: 0};\n * }\n * /**\n * * Set the\n * current context\n * * @param contexts: ExecutionContextInfo[] the current path of execution\n * * frames\n * * @\n * set currentContext(contexts: ExecutionContextInfo[]) {\n * if (this.contexts !== contexts) {\n * this.contexts =\n * contexts;\n * this.generateCurrentContextIds();\n * }\n * }\n * get currentContext(): ExecutionContextInfo[] {\n * return this.contexts;\n * }\n * /**\n * * Returns the current context in string format.\n * * @\n * get currentContextId():\n * string {\n * return this._currentContextIds[0];\n * }\n * /**\n * * Returns the current context and all parent contexts\n * in string format.\n * * This allow access to the nodes in the current and parent frames.\n * * @\n * get\n * currentContextIds(): string[] {\n * return this._currentContextIds;\n * }\n * private generateCurrentContextIds() {\n * const names = [];\n * for (let i = 0; i < this.contexts.length - 1; i++) {\n * const contexts = this.contexts.slice(0,\n * this.contexts.length - i);\n * names.push(this.contextIdforContexts(contexts));\n * }\n * names.push(\"\");\n * this._currentContextIds = names;\n * }\n * private contextIdforContexts(contexts:\n * ExecutionContextInfo[])\n * {\n * return contexts ?\n * contexts\n * .map(\n * context => (context.id\n * === 0 && context.iterationId === 0) ?\n * \"\n * `:${context.frameName}-\n * ${context.iterationId}`\n * .join('/') :\n * \"\n * \";\n * }\n * /**\n * * Enter a new frame, a new context is pushed on\n * the current context list.\n * * @param frameId new frame id\n * * @\n * enterFrame(frameId: string) {\n * if\n * (this.contexts)\n * {\n * this.lastId++;\n * this.contexts = this.contexts.slice();\n * this.contexts.push(this.newFrame(this.lastId, frameId));\n * }\n * this._currentContextIds.unshift(this.contextIdforContexts(this.contexts));\n * }\n * /**\n * * Exit the current\n * frame, the last context is removed from the current\n * * context list.\n * * @\n * exitFrame() {\n * if (this.contexts &&

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this.contexts.length > 1) {\n this.contexts = this.contexts.slice();\n this.contexts.splice(-1);\n this.currentContextIds.shift();\n } else {\n throw new Error('Cannot exit frame, the context is empty');\n }\n}\n\n /**\n * Enter the next iteration of a loop, the iteration id of last context is\n * increased.\n */\nnextIteration() {\n if (this.contexts && this.contexts.length > 0) {\n this.contexts = this.contexts.slice();\n this.lastId++;\n const context =\n Object.assign({}, this.contexts[this.contexts.length - 1]);\n context.iterationId += 1;\n context.id = this.lastId;\n this.contexts.splice(-1, 1, context);\n this._currentContextIds.splice(\n 0, 1, this.contextIdforContexts(this.contexts));\n } else {\n throw new\n Error('Cannot increase frame iteration, the context is empty');\n }\n}\n\n getWeight(name: string): Tensor[] {\n return this.weightMap[name];\n}\n\n addTensorArray(tensorArray: TensorArray) {\n this.tensorArrayMap[tensorArray.id] = tensorArray;\n}\n\n getTensorArray(id:\n number): TensorArray {\n return this.tensorArrayMap[id];\n}\n\n addTensorList(tensorList: TensorList) {\n this.tensorListMap[tensorList.id] = tensorList;\n}\n\n getTensorList(id: number): TensorList {\n return\n this.tensorListMap[id];\n}\n\n dispose(keepIds: Set<number>) {\n for (const key in this.tensorArrayMap) {\n this.tensorArrayMap[key].clearAndClose(keepIds);\n }\n\n for (const key in this.tensorListMap) {\n this.tensorListMap[key].clearAndClose(keepIds);\n }\n}\n}\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing,\n software\n distributed under the License is distributed on an "AS IS" BASIS,\n WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n See the License for the specific language\n governing permissions and\n limitations under the License.\n *\n =====\n\n */\n\nimport {NamedTensorMap} from 'tensorflow/tfjs-core';\nimport {NamedTensorsMap} from\n './data/types';\nimport {parseNodeName} from 'operations/executors/utils';\nimport {Graph, Node} from\n './operations/types';\n\nexport interface ExecutionInfo {\n inputs: NamedTensorMap;\n outputs: Node[];\n usedNodes: Set<string>;\n missingInputs: string[];\n dynamicNode: Node;\n syncInputs: string[];\n}\n\n/**\n * Given graph inputs and desired outputs, find the minimal set of nodes\n * to execute in order to compute the outputs.\n In addition return other useful\n * info such:\n * - Missing inputs needed to compute the output.\n * - Whether the\n subgraph contains dynamic ops (control flow, dynamic shape).\n * - Alternative inputs in order\n to avoid async (dynamic op) execution.\n\n */\n\nexport function getExecutionSubgraph(\n inputs:\n NamedTensorMap, outputs: Node[], weightMap: NamedTensorsMap,\n initNodes?: Node[]): ExecutionInfo {\n const usedNodes = new Set<string>();\n const missingInputs: string[] = [];\n let dynamicNode: Node = null;\n let\n syncInputs: string[] = null;\n\n // Start with the outputs, going backwards and find all the nodes that are\n // needed\n to compute those outputs.\n const seen = new Set<string>();\n const inputNodeNames =\n Object.keys(inputs).map(name => parseNodeName(name)[0]);\n let initNodeNames: string[] = [];\n if (initNodes\n != null) {\n initNodeNames = initNodes.map(node => parseNodeName(node.name)[0]);\n }\n\n const frontier =\n [...outputs];\n while (frontier.length > 0) {\n const node = frontier.pop();\n if (isControlFlow(node) ||\n isDynamicShape(node) || isHashTable(node)) {\n if (dynamicNode == null) {\n dynamicNode = node;\n }\n }\n\n syncInputs\n = dynamicNode.children.map(child => child.name)\n .filter(name => usedNodes.has(name));\n }\n\n usedNodes.add(node.name);\n\n // Weights are dead end since we already have their values.\n if\n (weightMap[node.name] != null) {\n continue;\n }\n\n // This node is a dead end since it's one of the user-\n provided inputs.\n if (inputNodeNames.indexOf(node.name) !== -1) {\n continue;\n }\n\n // This node is a\n dead end since it doesn't have any inputs.\n if (initNodeNames.indexOf(node.name) !== -1) {\n continue;\n }\n\n if (node.inputs.length === 0) {\n missingInputs.push(node.name);\n continue;\n }\n\n node.inputs.forEach(input => {\n // Don't add to the frontier if it is already there.\n if (seen.has(input.name))\n {\n return;\n }\n\n seen.add(input.name);\n frontier.push(input);\n });\n}\n\n return {inputs, outputs,\n usedNodes, missingInputs, dynamicNode, syncInputs};\n}\n\n/**\n
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* Given the execution info, return a list of nodes in topological order that
* need to be executed to compute the
output.
*/
nexport function getNodesInTopologicalOrder(
 graph: Graph, weightMap: NamedTensorsMap,
 executionInfo: ExecutionInfo): Node[] {
 const {usedNodes, inputs} = executionInfo;
 const frontier: Node[] = [];
 const inputNodes = Object.keys(inputs)
 .map(name => parseNodeName(name)[0])
 .map(name => graph.nodes[name]);
 const initNodes = graph.initNodes;
 inputNodes.forEach(input => {
 if (usedNodes.has(input.name)) {
 frontier.push(input);
 }
 });
 graph.weights.forEach(weight => {
 if (usedNodes.has(weight.name)) {
 frontier.push(weight);
 }
 });
 if (initNodes != null) {
 initNodes.forEach(node => {
 if (usedNodes.has(node.name)) {
 frontier.push(node);
 }
 });
 }
 const seen = new Set<string>();
 const orderedNodes:
 Node[] = [];
 while (frontier.length > 0) {
 const node = frontier.pop();
 seen.add(node.name);
 if (!weightMap[node.name]) {
 orderedNodes.push(node);
 }
 node.children.forEach(child => {
 if (!seen.has(child.name) && usedNodes.has(child.name) &&
 child.inputs.every(input =>
 seen.has(input.name))) {
 frontier.push(child);
 }
 });
 }
 return orderedNodes;
}

const CONTROL_FLOW_OPS = ['Switch', 'Merge', 'Enter', 'Exit', 'NextIteration', 'StatelessIf',
 'StatelessWhile', 'if', 'While'];
const DYNAMIC_SHAPE_OPS = ['NonMaxSuppressionV2', 'NonMaxSuppressionV3',
 'NonMaxSuppressionV5', 'Where'];
const HASH_TABLE_OPS = ['HashTable', 'HashTableV2',
 'LookupTableImport', 'LookupTableImportV2',
 'LookupTableFind', 'LookupTableFindV2'];

nexport function isControlFlow(node: Node) {
 return CONTROL_FLOW_OPS.indexOf(node.op) >= 0;
}

nexport function isDynamicShape(node: Node) {
 return DYNAMIC_SHAPE_OPS.indexOf(node.op)
 >= 0;
}

nexport function isHashTable(node: Node) {
 return HASH_TABLE_OPS.indexOf(node.op) >=
 0;
}
}

/**
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 * limitations under the License.

```

```

=====
*/
nimport {DataType, NamedTensorMap, Tensor, tidy, util} from '@tensorflow/tfjs-core';
nimport {ISignatureDef} from './data/compiled_api';
nimport {NamedTensorsMap, TensorArrayMap, TensorInfo, TensorListMap} from './data/types';
nimport {getNodeNameAndIndex, getParamValue, getTensor, getTensorsForCurrentContext, parseNodeName} from
 './operations/executors/utils';
nimport {executeOp} from './operations/operation_executor';
nimport {Graph, Node} from './operations/types';
nimport {ExecutionContext, ExecutionContextInfo} from './execution_context';
nimport {getExecutionSubgraph, getNodesInTopologicalOrder, isControlFlow} from './model_analysis';
nimport {ResourceManager} from './resource_manager';
nimport {FunctionExecutor} from './types';

ninterface NodeWithContexts {
 contexts: ExecutionContextInfo[];
 node: Node;
}

nexport class GraphExecutor implements FunctionExecutor {
 private compiledMap: Map<string, Node[]> = new Map();
 private _weightMap: NamedTensorsMap = {};
 private _weightIds: number[];
 private _signature: ISignatureDef;
 private _inputs: Node[];
 private _outputs: Node[];
 private _initNodes: Node[];
 // Internal init nodes to start initialization.
 private SEPERATOR = ',';
 private _functions: {[key: string]: Graph} = {};
 private _functionExecutorMap: {[key: string]: FunctionExecutor} = {};
 private _resourceManager: ResourceManager;

 get weightIds(): number[] {
 return this.parent ? this.parent.weightIds : this._weightIds;
 }

 get functionExecutorMap(): {[key: string]: FunctionExecutor} {
 return this.parent ? this.parent.functionExecutorMap : this._functionExecutorMap;
 }

 get weightMap(): NamedTensorsMap {
 return this.parent ? this.parent.weightMap : this._weightMap;
 }

 set weightMap(weightMap: NamedTensorsMap) {
 const weightIds = Object.keys(weightMap).map(key => weightMap[key].map(tensor => tensor.id));
 this._weightIds = [].concat(...weightIds);
 this._weightMap = weightMap;
 }

 /**
 * Set `ResourceManager` shared by executors of a model.
 * @param

```



resourceManager:

```
`ResourceManager` of the `GraphModel`.n */n set resourceManager(resourceManager: ResourceManager) {\n this._resourceManager = resourceManager;\n }\n\n get inputs(): TensorInfo[] {\n return this._inputs.map(node\n => {\n return {\n name: node.name,\n shape: node.attrParams['shape'] ?\n node.attrParams['shape'].value as number[] :\n undefined,\n dtype: node.attrParams['dtype'] ?\n node.attrParams['dtype'].value as DataType :\n undefined\n };\n });\n }\n\n get outputs(): TensorInfo[]\n {\n return this._outputs.map(node => {\n return {\n name: node.name,\n shape:\n node.attrParams['shape'] ?\n node.attrParams['shape'].value as number[] :\n undefined,\n dtype:\n node.attrParams['dtype'] ?\n node.attrParams['dtype'].value as DataType :\n undefined\n };\n });\n }\n\n get inputNodes(): string[] {\n return this._inputs.map(node\n => node.signatureKey || node.name);\n }\n\n get outputNodes(): string[] {\n return this._outputs.map((node) =>\n {\n const name = node.signatureKey || node.name;\n return node.defaultOutput ?\n (`${name}:${node.defaultOutput}`) : name;\n });\n }\n\n get functions(): {[key: string]: ISignatureDef} {\n return Object.keys(this._functions).reduce((map, key) => {\n map[key] = this._functions[key].signature;\n return map;\n }, {} as {[key: string]: ISignatureDef});\n }\n\n /**\n * @param graph Graph the model or\n * function graph to be executed.\n * @param parent When building function executor you need to set the parent\n * executor. Since the weights and function executor maps are set at parent\n * level, that function executor can\n * access the function maps and weight maps\n * through the parent.\n */\n constructor(private graph: Graph,\n private parent?: GraphExecutor) {\n this._outputs = graph.outputs;\n this._inputs = graph.inputs;\n this._initNodes = graph.initNodes;\n this._signature = graph.signature;\n this._functions = graph.functions;\n // create sub-graph executors\n if (graph.functions != null) {\n Object.keys(graph.functions).forEach(name =>\n {\n this._functionExecutorMap[name] =\n new GraphExecutor(graph.functions[name], this);\n });\n }\n }\n\n private getCompilationKey(inputs: Node[], outputs: Node[]): string {\n const sortedInputs =\n inputs.map(node => node.name).sort();\n const sortedOutputs = outputs.map(node => node.name).sort();\n return sortedInputs.join(this.SEPERATOR) + '--' +\n sortedOutputs.join(this.SEPERATOR);\n }\n\n /**\n * Compiles the inference graph and returns the minimal set of nodes that are\n * required for execution, in the correct\n * execution order.\n */\n private compile(inputs: NamedTensorMap, outputs: Node[]): Node[] {\n const\n executionInfo =\n getExecutionSubgraph(inputs, outputs, this.weightMap,\n this._initNodes);\n const {missingInputs, dynamicNode, syncInputs} = executionInfo;\n if (dynamicNode !=\n null) {\n throw new Error(\n `This execution contains the node '${dynamicNode.name}', which has\n `the dynamic op '${dynamicNode.op}'. Please use\n `model.executeAsync() instead. Alternatively, to\n avoid the\n `dynamic ops, specify the inputs [${syncInputs}]);\n }\n if (missingInputs.length > 0) {\n const outNames = outputs.map(n => n.name);\n const inNames = Object.keys(inputs);\n throw new Error(\n `Cannot compute the outputs [${outNames}] from the provided inputs\n ` [${inNames}]. Missing the\n following inputs: [${missingInputs}]);\n }\n return getNodesInTopologicalOrder(\n this.graph,\n this.weightMap, executionInfo);\n }\n\n /**\n * Executes the inference for given input tensors.\n * @param\n * inputs Tensor map for the model inputs, keyed by the input\n * node\n * @param\n * names Optional. output node name from the Tensorflow model, if\n * no outputs\n * are specified, the default outputs of the model would be used.\n * @param\n * outputs Optional. output node name from the Tensorflow model, if\n * no outputs\n * are specified, the default outputs of the model would be used.\n * You can inspect intermediate nodes of the model\n * by adding them to the\n * outputs array.\n */\n execute(inputs: NamedTensorMap, outputs?: string[]): Tensor[]\n {\n inputs = this.mapInputs(inputs);\n const names = Object.keys(inputs).sort();\n this.checkInputs(inputs);\n this.checkInputShapeAndType(inputs);\n outputs = this.mapOutputs(outputs);\n this.checkOutputs(outputs);\n const inputNodes =\n names.map(name => this.graph.nodes[parseNodeName(name)[0]]);\n const\n outputNodeNames = outputs.map(name => parseNodeName(name)[0]);\n let outputNodes =\n outputNodeNames.map(name => this.graph.nodes[name]);\n // If no outputs are specified, then use the default\n outputs of the model.\n if (outputNodes.length === 0) {\n outputNodes = this._outputs;\n }\n const\n compilationKey
```



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async _executeAsync(\n inputs: NamedTensorMap, outputs?: string[], isFunctionExecution = false,\n tensorArrayMap: TensorArrayMap = {},\n tensorListMap: TensorListMap = {}): Promise<Tensor[]> {\n if\n (!isFunctionExecution) {\n inputs = this.mapInputs(inputs);\n this.checkInputs(inputs);\n this.checkInputShapeAndType(inputs);\n outputs = this.mapOutputs(outputs);\n this.checkOutputs(outputs);\n }\n const context = new ExecutionContext(\n this.weightMap, tensorArrayMap, tensorListMap,\n this.functionExecutorMap);\n // Graph with control flow op requires runtime evaluation of the execution\n // order, while without control flow the execution order is pre-determined\n // in the compile method.\n const tensorMap = await this.executeWithControlFlow(\n inputs, context, outputs, isFunctionExecution);\n const results = outputs.map(name => getTensor(name, tensorMap, context));\n // dispose all the intermediate\n tensors\n const outputIds = results.map(t => t.id);\n const inputIds = Object.keys(inputs).map(name =>\n inputs[name].id);\n const keepIds =\n new Set<number>([...outputIds, ...inputIds, ...this.weightIds]);\n Object.keys(tensorMap).forEach(key => {\n const tensorArray = tensorMap[key];\n tensorArray.forEach(tensor => {\n if (tensor && !tensor.isDisposed && !keepIds.has(tensor.id)) {\n tensor.dispose();\n }\n });\n });\n // dispose the context for the root executor\n if (this.parent == null)\n {\n context.dispose(keepIds);\n }\n return results;\n}\n\nasync executeFunctionAsync(\n inputs:\n Tensor[], tensorArrayMap: TensorArrayMap,\n tensorListMap: TensorListMap): Promise<Tensor[]>\n {\n const mappedInputs = inputs.reduce((map, tensor, index) => {\n map[this.inputs[index].name] = tensor;\n return map;\n }, {} as NamedTensorMap);\n return this._executeAsync(\n mappedInputs,\n this.outputNodes, true, tensorArrayMap, tensorListMap);\n }\n /**\n * When there are control flow nodes in the\n * graph, the graph execution use\n * ExecutionContext to keep track of the frames and loop iterators.\n * @param\n * inputs placeholder tensors for the graph.\n * @param context the execution context object for current execution.\n * @param outputNames Optional. output node name from the Tensorflow model,\n * if no outputs are specified,\n * the default outputs of the model would be\n * used. You can inspect intermediate nodes of the model by adding\n * them to the\n * outputs array.\n * @param isFunctionExecution Flag for executing a function.\n */\n private\n async executeWithControlFlow(\n inputs: NamedTensorMap, context: ExecutionContext,\n outputNames?: string[],\n isFunctionExecution?: boolean): Promise<NamedTensorsMap> {\n const names =\n Object.keys(inputs);\n const inputNodes =\n names.map(name =>\n this.graph.nodes[parseNodeName(name)[0]]);\n const outputNodeNames = outputNames.map(name =>\n parseNodeName(name)[0]);\n let outputNodes = outputNodeNames.map(name => this.graph.nodes[name]);\n // If no outputs are specified, then use the default outputs of the model.\n if (outputNodes.length === 0) {\n outputNodes = this._outputs;\n }\n const {usedNodes, missingInputs, dynamicNode, syncInputs} =\n getExecutionSubgraph(\n inputs, outputNodes, this.weightMap, this._initNodes);\n // First nodes to\n execute include inputNodes, weights, and initNodes.\n const stack: NodeWithContexts[] = [\n ...inputNodes,\n ...this.graph.weights, ...(\n this._initNodes || []\n)\n].map(node => {\n return {node, contexts:\n context.currentContext};\n });\n const tensorsMap:\n NamedTensorsMap = {...this.weightMap};\n Object.keys(inputs).forEach(name => {\n const [nodeName,\n index] = parseNodeName(name);\n const tensors: Tensor[] = [];\n tensors[index] = inputs[name];\n tensorsMap[nodeName] = tensors;\n });\n const intermediateTensorConsumerCount: {[key: number]: number} =\n {};\n const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n const added: {[key: string]: boolean} =\n {};\n while (stack.length > 0) {\n const promises = this.processStack(\n inputNodes, stack, context,\n tensorsMap, added, tensorsToKeep,\n outputNodeNames, intermediateTensorConsumerCount, usedNodes);\n await Promise.all(promises);\n }\n if (dynamicNode == null && !isFunctionExecution) {\n console.warn(\n `This model execution did not contain any nodes with control flow `+\n `or dynamic output shapes. You\n can use model.execute() instead.`);\n }\n const missingOutputs =\n outputNodes\n .filter(\n node => !isControlFlow(node) &&\n !getTensor(node.name, tensorsMap,\n context))\n .map(node => node.name);\n if (missingOutputs.length > 0) {\n let alternativeMsg = ";\n if (dynamicNode != null) {\n alternativeMsg =\n `Alternatively, to avoid the dynamic ops, use\n model.execute() `+\n `and specify the inputs [${syncInputs}]`;\n }\n throw new Error(\n `Cannot

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compute the outputs [${missingOutputs}] from the provided `+` inputs [${names}]. Consider providing the
following inputs: `+` [${missingInputs}]. ${alternativeMsg}');\n } return tensorsMap;\n }\n\n private
processStack(\n inputNodes: Node[], stack: NodeWithContexts[], context: ExecutionContext,\n tensorMap:
NamedTensorsMap, added: {[key: string]: boolean},\n tensorsToKeep: Set<number>, outputNames: string[],\n intermediateTensorConsumerCount:
{[key: number]: number},\n usedNodes: Set<string>) {\n const promises: Array<Promise<Tensor[]>> = [];\n while (stack.length > 0) {\n const item = stack.pop();\n context.currentContext = item.contexts;\n let
nodeName = '';\n // The tensor of the Enter op with isConstant set should be set\n // in the parent scope, so it
will be available as constant for the\n // whole loop.\n if (item.node.op === 'Enter' &&\n getParamValue('isConstant', item.node, tensorMap, context)) {\n [nodeName] =
getNodeNameAndIndex(item.node.name, context);\n }\n\n // only process nodes that are not in the tensorMap
yet, this include\n // inputNodes and internal initNodes.\n if (tensorMap[item.node.name] == null) {\n
const tensors =\n executeOp(item.node, tensorMap, context, this._resourceManager);\n if (!nodeName)
{\n [nodeName] = getNodeNameAndIndex(item.node.name, context);\n }\n const
currentContext = context.currentContext;\n if (util.isPromise(tensors)) {\n promises.push((tensors as
Promise<Tensor[]>).then(t => {\n tensorMap[nodeName] = t;\n context.currentContext =
currentContext;\n this.checkTensorForDisposal(\n nodeName, item.node, tensorMap, context,
tensorsToKeep,\n outputNames, intermediateTensorConsumerCount);\n this.processChildNodes(\n
 item.node, stack, context, tensorMap, added, usedNodes);\n return t;\n }));\n } else {\n
tensorMap[nodeName] = tensors as Tensor[];\n this.checkTensorForDisposal(\n nodeName,
item.node, tensorMap, context, tensorsToKeep,\n outputNames, intermediateTensorConsumerCount);\n
this.processChildNodes(\n item.node, stack, context, tensorMap, added, usedNodes);\n }\n } else {\n
this.processChildNodes(\n item.node,
stack, context, tensorMap, added, usedNodes);\n }\n }\n return promises;\n }\n\n private
processChildNodes(\n node: Node, stack: NodeWithContexts[], context: ExecutionContext,\n tensorMap:
NamedTensorsMap, added: {[key: string]: boolean},\n usedNodes: Set<string>) {\n
node.children.forEach((childNode) => {\n const [nodeName,] = getNodeNameAndIndex(childNode.name,
context);\n if (added[nodeName] || !usedNodes.has(childNode.name)) {\n return;\n }\n // Merge op can
be pushed if any of its inputs has value.\n if (childNode.op === 'Merge') {\n if
(childNode.inputNames.some(name => {\n return !!getTensor(name, tensorMap, context);\n }))) {\n
added[nodeName] = true;\n stack.push({ contexts: context.currentContext, node: childNode });\n }\n
} else // Otherwise all inputs must to have value.\n if (childNode.inputNames.every(name => {\n
return
!!getTensor(name, tensorMap, context);\n }))) {\n added[nodeName] = true;\n
stack.push({ contexts: context.currentContext, node: childNode });\n }\n });\n }\n\n /**\n * Releases the
memory used by the weight tensors.\n */\n dispose() {\n Object.keys(this.weightMap)\n .forEach(\n
key => this.weightMap[key].forEach(tensor => tensor.dispose());\n }\n\n private
checkInputShapeAndType(inputs: NamedTensorMap) {\n Object.keys(inputs).forEach(name => {\n const
input = inputs[name];\n const [nodeName,] = parseNodeName(name);\n const node =
this.graph.nodes[nodeName];\n if (node.attrParams['shape'] && node.attrParams['shape'].value) {\n const
shape = node.attrParams['shape'].value as number[];\n const match = shape.length === input.shape.length &&\n
input.shape.every(\n (dim, index) => shape[index] === -1 || shape[index] === dim);\n
util.assert(\n match,\n
() => `The shape of dict['${node.name}'] provided in ` +\n `model.execute(dict) must be
[${shape}], but was ` +\n `${input.shape}`);\n }\n if (node.attrParams['dtype'] &&
node.attrParams['dtype'].value) {\n util.assert(\n input.dtype === node.attrParams['dtype'].value as
string,\n () => `The dtype of dict['${node.name}'] provided in ` +\n `model.execute(dict) must be `
+\n `${node.attrParams['dtype'].value}, but was ${input.dtype}`);\n }\n });\n }\n\n private

```

```

mapInputs(inputs: NamedTensorMap) {\n const result: NamedTensorMap = {};\n for (const inputName in
inputs) {\n if (this._signature != null && this._signature.inputs != null &&\n
this._signature.inputs[inputName] != null) {\n const tensor = this._signature.inputs[inputName];\n
result[tensor.name] = inputs[inputName];\n } else {\n result[inputName] = inputs[inputName];\n
 }\n }\n return result;\n }\n\n private checkInputs(inputs: NamedTensorMap) {\n const notInGraph =
Object.keys(inputs).filter(name => {\n const [nodeName] = parseNodeName(name);\n return
this.graph.nodes[nodeName] == null;\n });\n if (notInGraph.length > 0) {\n throw new Error(\n `The
dict provided in model.execute(dict) has ` +\n `keys: [${notInGraph}] that are not part of graph`);\n }\n
}\n\n private mapOutputs(outputs: string[]) {\n return outputs.map(name => {\n if (this._signature != null &&
this._signature.outputs != null &&\n this._signature.outputs[name] != null) {\n const tensor =
this._signature.outputs[name];\n return tensor.name;\n }\n return name;\n }, {});\n }\n\n private
checkOutputs(outputs: string[]): void {\n outputs.forEach(name => {\n const [normalizedName] =
parseNodeName(name);\n if (!this.graph.nodes[normalizedName]) {\n throw new
Error(`The output '${name}' is not found in the graph`);\n }\n });\n }\n\n}

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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

\n\n=====
\n\n*/\nimport {HashMap, NamedTensorMap} from '../data/types';\nimport {HashTable} from
'/hash_table';\n\n/**\n * Contains global resources of a model.\n */\nexport class ResourceManager {\n
 constructor(\n readonly hashTableNameToHandle: NamedTensorMap = {},\n readonly hashMap:
HashMap = {}) {\n }\n\n /**\n * Register a `HashTable` in the resource manager.\n * The `HashTable`
can be retrieved by `resourceManager.getHashTableById`,\n * where id is the table handle tensor's id.\n *
@param name Op node name that creates the `HashTable`.\n * @param hashTable The `HashTable` to be added to
resource manager.\n */\n addHashTable(name: string, hashTable: HashTable) {\n
 this.hashTableNameToHandle[name] = hashTable.handle;\n this.hashTableMap[hashTable.id] = hashTable;\n
 }\n\n /**\n * Get the table handle by node name.\n * @param name Op node name that creates the `HashTable`.
This name is also\n * used in the inputs list of lookup and import `HashTable` ops.\n */\n getHashTableHandleByName(name: string) {\n
 return this.hashTableNameToHandle[name];\n }\n\n /**\n * Get the actual `HashTable` by its handle tensor's
id.\n * @param id The id of the handle tensor.\n */\n getHashTableById(id: number): HashTable {\n
 return this.hashTableMap[id];\n }\n\n /**\n * Dispose `ResourceManager`, including its hashTables and tensors in
them.\n */\n dispose() {\n for (const key in this.hashTableMap) {\n
 this.hashTableMap[key].clearAndClose();\n delete this.hashTableMap[key];\n }\n\n for (const name in
this.hashTableNameToHandle) {\n this.hashTableNameToHandle[name].dispose();\n delete
this.hashTableNameToHandle[name];\n }\n }\n\n}

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Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS
IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

\n\n=====
\n\n*/\nimport {InferenceModel, io, ModelPredictConfig, NamedTensorMap, Tensor} from 'tensorflow/tfjs-
core';\nimport * as tensorflow from '../data/compiled_api';\nimport {NamedTensorsMap, TensorInfo} from

```

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'./data/types';\nimport {OperationMapper} from './operations/operation_mapper';\n\nimport {GraphExecutor} from
'./graph_executor';\nimport {ResourceManager} from './resource_manager';\n\nexport const
TFHUB_SEARCH_PARAM = '?tfjs-format=file';\nexport const DEFAULT_MODEL_NAME =
'model.json';\n/**\n * A `tf.GraphModel` is a directed, acyclic graph built from a\n * SavedModel GraphDef and
allows inference execution.\n *\n * A `tf.GraphModel` can only be created by loading from a model converted
from\n * a [TensorFlow
SavedModel](https://www.tensorflow.org/guide/saved_model) using\n * the command line converter tool and
loaded via `tf.loadGraphModel`.\n *\n * @doc {heading: 'Models', subheading: 'Classes'}\n */\nexport class
GraphModel implements InferenceModel {\n private executor: GraphExecutor;\n private version = 'n/a';\n private
handler: io.IOHandler;\n private artifacts: io.ModelArtifacts;\n private initializer: GraphExecutor;\n private
resourceManager: ResourceManager;\n private signature: tensorflow.ISignatureDef;\n\n // Returns the version
information for the tensorflow model GraphDef.\n get modelVersion(): string {\n return this.version;\n }\n\n get
inputNodes(): string[] {\n return this.executor.inputNodes;\n }\n\n get outputNodes(): string[] {\n return
this.executor.outputNodes;\n }\n\n get inputs(): TensorInfo[] {\n return this.executor.inputs;\n }\n\n get
outputs(): TensorInfo[] {\n return this.executor.outputs;\n }\n\n get weights(): NamedTensorsMap
{\n return this.executor.weightMap;\n }\n\n get metadata(): {} {\n return this.artifacts.userDefinedMetadata;\n
}\n\n get modelSignature(): {} {\n return this.signature;\n }\n\n /**\n * @param modelUrl url for the model, or
an `io.IOHandler`.\n * @param weightManifestUrl url for the weight file generated by\n * scripts/convert.py
script.\n * @param requestOptions options for Request, which allows to send credentials\n * and custom
headers.\n * @param onProgress Optional, progress callback function, fired periodically\n * before the load is
completed.\n */\n constructor(\n private modelUrl: string|io.IOHandler,\n private loadOptions:
io.LoadOptions = {})\n {\n if (loadOptions == null) {\n this.loadOptions = {};\n }\n this.resourceManager =
new ResourceManager();\n }\n\n private findIOHandler() {\n const path = this.modelUrl;\n if ((path as
io.IOHandler).load != null) {\n // Path is an IO Handler.\n this.handler
= path as io.IOHandler;\n } else if (this.loadOptions.requestInit != null) {\n this.handler =
io.browserHTTPRequest(path as string, this.loadOptions);\n } else {\n const handlers =
io.getLoadHandlers(path as string, this.loadOptions);\n if (handlers.length === 0) {\n // For backward
compatibility: if no load handler can be found,\n // assume it is a relative http path.\n handlers.push(io.browserHTTPRequest(path as string, this.loadOptions));\n } else if (handlers.length > 1) {\n throw new Error(\n `Found more than one (${handlers.length}) load handlers for ` +\n `URL
`${path}``);\n }\n this.handler = handlers[0];\n }\n }\n\n /**\n * Loads the model and weight files,
construct the in memory weight map and\n * compile the inference graph.\n */\n async load(): Promise<boolean>
{\n this.findIOHandler();\n if (this.handler.load == null) {\n throw new Error(\n `Cannot proceed
with model loading because the IOHandler provided ` +\n `does not have the `load` method implemented.`);\n }\n const artifacts = await this.handler.load();\n return this.loadSync(artifacts);\n }\n\n /**\n *
Synchronously construct the in memory weight map and\n * compile the inference graph. Also initialize hashtable
if any.\n */\n @doc {heading: 'Models', subheading: 'Classes', ignoreCI: true}\n loadSync(artifacts:
io.ModelArtifacts) {\n this.artifacts = artifacts;\n const graph = this.artifacts.modelTopology as
tensorflow.IGraphDef;\n\n let signature;\n if (this.artifacts.userDefinedMetadata != null &&\n this.artifacts.userDefinedMetadata.signature != null) {\n signature = // tslint:disable-next-line:no-any\n (this.artifacts.userDefinedMetadata as any).signature as\n tensorflow.ISignatureDef;\n } else {\n signature
= this.artifacts.signature;\n }\n this.signature = signature;\n\n this.version = `${graph.versions.producer}.${graph.versions.minConsumer}`;\n const weightMap =\n io.decodeWeights(this.artifacts.weightData, this.artifacts.weightSpecs);\n this.executor = new GraphExecutor(\n
 OperationMapper.Instance.transformGraph(graph, this.signature);\n this.executor.weightMap =
this.convertTensorMapToTensorsMap(weightMap);\n // Attach a model-level resourceManager to each executor
to share resources,\n // such as `HashTable`.\n this.executor.resourceManager = this.resourceManager;\n\n if
(artifacts.modelInitializer != null &&\n (artifacts.modelInitializer as tensorflow.IGraphDef).node != null) {\n

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const initializer =\n OperationMapper.Instance.transformGraph(artifacts.modelInitializer);\n this.initializer\n = new GraphExecutor(initializer);\n this.initializer.weightMap = this.executor.weightMap;\n // Attach a\n model-level resourceManager to the initializer, the\n // hashTables created from when\n executing the initializer will be stored\n // in the resourceManager.\n this.initializer.resourceManager =\n this.resourceManager;\n this.initializer.executeAsync({}, []);\n }\n return true;\n }\n /**\n * Save the\n configuration and/or weights of the GraphModel.\n *\n * An `IOHandler` is an object that has a `save` method of\n the proper\n * signature defined. The `save` method manages the storing or\n * transmission of serialized data\n ("artifacts") that represent the\n * model's topology and weights onto or via a specific medium, such as\n * file\n downloads, local storage, IndexedDB in the web browser and HTTP\n * requests to a server. TensorFlow.js\n provides `IOHandler`\n * implementations for a number of frequently used saving mediums, such as\n *\n `tf.io.browserDownloads` and `tf.io.browserLocalStorage`. See `tf.io`\n * for more details.\n *\n * This method\n also allows you to refer to certain types of `IOHandler`\n * as URL-like\n string shortcuts, such as 'localStorage://' and\n * 'indexeddb://'.\n *\n * Example 1: Save `model`'s topology and\n weights to browser [local\n * storage](https://developer.mozilla.org/en-\n US/docs/Web/API/Window/localStorage);\n * then load it back.\n *\n * ```\n js\n * const modelUrl =\n * 'https://storage.googleapis.com/tfjs-models/savedmodel/mobilenet_v2_1.0_224/model.json';\n * const model =\n await tf.loadGraphModel(modelUrl);\n * const zeros = tf.zeros([1, 224, 224, 3]);\n *\n model.predict(zeros).print();\n *\n * const saveResults = await model.save('localStorage://my-model-1');\n *\n * const loadedModel = await tf.loadGraphModel('localStorage://my-model-1');\n * console.log('Prediction from\n loaded model:');\n * model.predict(zeros).print();\n * ```\n *\n * @param handlerOrURL An instance of\n `IOHandler` or a URL-like,\n * scheme-based string shortcut for `IOHandler`.\n *\n * @param config Options for\n saving the model.\n *\n * @returns A `Promise`\n of `SaveResult`, which summarizes the result of\n * the saving, such as byte sizes of the saved artifacts for the\n model's\n * topology and weight values.\n *\n * @doc {heading: 'Models', subheading: 'Classes', ignoreCI:\n true}\n *\n async save(handlerOrURL: io.IOHandler|string, config?: io.SaveConfig):\n Promise<io.SaveResult> {\n if (typeof handlerOrURL === 'string') {\n const handlers =\n io.getSaveHandlers(handlerOrURL);\n if (handlers.length === 0) {\n throw new Error(\n `Cannot find\n any save handlers for URL '${handlerOrURL}'`);\n } else if (handlers.length > 1) {\n throw new Error(\n `Found more than one (${handlers.length}) save handlers for\n ` +\n `URL '${handlerOrURL}'`);\n }\n handlerOrURL = handlers[0];\n }\n if (handlerOrURL.save == null) {\n throw new Error(\n `GraphModel.save() cannot proceed because the IOHandler '\n +\n 'provided does not have the `save`\n attribute defined.`);\n }\n return handlerOrURL.save(this.artifacts);\n }\n }\n /**\n * Execute the inference for\n the input tensors.\n *\n * @param input The input tensors, when there is single input for the model,\n * inputs\n param should be a `tf.Tensor`. For models with multiple inputs,\n * inputs\n params should be in either `tf.Tensor` []\n if the input order is\n * fixed, or otherwise NamedTensorMap format.\n *\n * For model with multiple inputs,\n we recommend you use NamedTensorMap as the\n * input type, if you use `tf.Tensor` [], the order of the array\n needs to\n * follow the\n * order of inputNodes array. @see {@link GraphModel.inputNodes}\n *\n * You can\n also feed any intermediate nodes using the NamedTensorMap as the\n * input type. For example, given the graph\n *\n * InputNode => Intermediate => OutputNode,\n * you can execute the subgraph Intermediate => OutputNode by\n calling\n * model.execute('IntermediateNode' : tf.tensor(...));\n *\n *\n * This is useful for models that uses tf.dynamic_rnn, where the intermediate\n * state needs to be fed\n manually.\n *\n * For batch inference execution, the tensors for each input need to be\n * concatenated together.\n For example with mobilenet, the required input shape\n * is [1, 224, 224, 3], which represents the [batch, height,\n width, channel].\n *\n * If we are provide a batched data of 100 images, the input tensor should be\n * in the shape of\n [100, 224, 224, 3].\n *\n * @param config Prediction configuration for specifying the batch size and\n * output\n node names. Currently the batch size option is ignored for graph\n * model.\n *\n * @returns Inference result\n tensors. The output would be single `tf.Tensor`\n * if model has single output node, otherwise Tensor[] or\n NamedTensorMap[]\n * will be returned for model with multiple outputs.\n *\n * @doc {heading: 'Models',

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subheading: 'Classes'}\n *^\n predict(inputs: Tensor|Tensor[]|NamedTensorMap,
config?: ModelPredictConfig):\n Tensor|Tensor[]|NamedTensorMap {\n return this.execute(inputs,
this.outputNodes);\n }\n\n private normalizeInputs(inputs: Tensor|Tensor[]|\n NamedTensorMap):
NamedTensorMap {\n if (!(inputs instanceof Tensor) && !Array.isArray(inputs)) {\n // The input is already a
NamedTensorMap.\n return inputs;\n }\n inputs = Array.isArray(inputs) ? inputs : [inputs];\n if
(inputs.length !== this.inputNodes.length) {\n throw new Error(\n 'Input tensor count mismatch,' +\n
`the graph model has ${this.inputNodes.length} placeholders, ` +\n `while there are ${inputs.length} input
tensors.`);\n }\n return this.inputNodes.reduce((map, inputName, i) => {\n map[inputName] = (inputs as
Tensor[])[i];\n return map;\n }, {} as NamedTensorMap);\n }\n\n private normalizeOutputs(outputs:
string|string[]): string[] {\n outputs = outputs || this.outputNodes;\n return
!Array.isArray(outputs) ? [outputs] : outputs;\n }\n\n /**\n * Executes inference for the model for given input
tensors.\n * @param inputs tensor, tensor array or tensor map of the inputs for the\n * model, keyed by the input
node names.\n * @param outputs output node name from the Tensorflow model, if no\n * outputs are specified,
the default outputs of the model would be used.\n * You can inspect intermediate nodes of the model by adding
them to the\n * outputs array.\n * \n * @returns A single tensor if provided with a single output or no outputs\n
* are provided and there is only one default output, otherwise return a\n * tensor array. The order of the tensor
array is the same as the outputs\n * if provided, otherwise the order of outputNodes attribute of the model.\n
*\n * @doc {heading: 'Models', subheading: 'Classes'}\n *^\n execute(inputs: Tensor|Tensor[]|NamedTensorMap,
outputs?: string|string[]):\n Tensor|Tensor[] {\n inputs = this.normalizeInputs(inputs);\n
outputs = this.normalizeOutputs(outputs);\n const result = this.executor.execute(inputs, outputs);\n return
result.length > 1 ? result : result[0];\n }\n\n /**\n * Executes inference for the model for given input tensors in
async\n * fashion, use this method when your model contains control flow ops.\n * @param inputs tensor, tensor
array or tensor map of the inputs for the\n * model, keyed by the input node names.\n * @param outputs output
node name from the Tensorflow model, if no outputs\n * are specified, the default outputs of the model would be
used. You can\n * inspect intermediate nodes of the model by adding them to the outputs\n * array.\n * \n *
@returns A Promise of single tensor if provided with a single output or\n * no outputs are provided and there is
only one default output, otherwise\n * return a tensor map.\n * \n * @doc {heading: 'Models', subheading:
'Classes'}\n *^\n async executeAsync(\n inputs:
Tensor|Tensor[]|NamedTensorMap,\n outputs?: string|string[]): Promise<Tensor|Tensor[]> {\n inputs =
this.normalizeInputs(inputs);\n outputs = this.normalizeOutputs(outputs);\n const result = await
this.executor.executeAsync(inputs, outputs);\n return result.length > 1 ? result : result[0];\n }\n\n private
convertTensorMapToTensorsMap(map: NamedTensorMap): NamedTensorsMap {\n return
Object.keys(map).reduce((newMap: NamedTensorsMap, key) => {\n newMap[key] = [map[key]];\n return
newMap;\n }, {});\n }\n\n /**\n * Releases the memory used by the weight tensors and resourceManager.\n
*\n * @doc {heading: 'Models', subheading: 'Classes'}\n *^\n dispose() {\n this.executor.dispose();\n\n if
(this.initializer) {\n this.initializer.dispose();\n }\n\n this.resourceManager.dispose();\n }\n}\n\n/**\n * Load
a graph model given a URL to the model definition.\n *\n * Example of loading MobileNetV2 from a URL and
making a prediction with
a\n * zeros input:\n *\n * ```js\n * const modelUrl =\n * 'https://storage.googleapis.com/tfjs-
models/savedmodel/mobilenet_v2_1.0_224/model.json';\n * const model = await tf.loadGraphModel(modelUrl);\n *
const zeros = tf.zeros([1, 224, 224, 3]);\n * model.predict(zeros).print();\n * ```\n *\n * Example of loading
MobileNetV2 from a TF Hub URL and making a prediction with\n * a zeros input:\n *\n * ```js\n * const modelUrl
=\n * 'https://tfhub.dev/google/imagenet/mobilenet_v2_140_224/classification/2';\n * const model = await
tf.loadGraphModel(modelUrl, {fromTFHub: true});\n * const zeros = tf.zeros([1, 224, 224, 3]);\n *
model.predict(zeros).print();\n * ```\n *\n * @param modelUrl The url or an `io.IOHandler` that loads the model.\n
*\n * @param options Options for the HTTP request, which allows to send credentials\n * and custom headers.\n
*\n * @doc {heading: 'Models', subheading: 'Loading'}\n *^\n export async function loadGraphModel(\n modelUrl:
string|io.IOHandler,\n options:

```



```

io.LoadOptions = {}): Promise<GraphModel> {\n if (modelUrl == null) {\n throw new Error(\n 'modelUrl in
loadGraphModel() cannot be null. Please provide a url '+\n 'or an IOHandler that loads the model');\n }\n if
(options == null) {\n options = {};\n }\n if (options.fromTFHub) {\n if ((modelUrl as io.IOHandler).load ==
null) {\n if (!(modelUrl as string).endsWith('/')) {\n modelUrl = (modelUrl as string) + '/';\n }\n
modelUrl = `${modelUrl}${DEFAULT_MODEL_NAME}${TFHUB_SEARCH_PARAM}`;\n }\n }\n const
model = new GraphModel(modelUrl, options);\n await model.load();\n return
model;\n}\n\n,null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,\"/*\n * dat-gui
JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google
Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except
in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n\nimport Color from './color/Color';\nimport math from
 './color/math';\nimport interpret from './color/interpret';\nimport Controller from './controllers/Controller';\nimport
BooleanController from './controllers/BooleanController';\nimport OptionController from
 './controllers/OptionController';\nimport StringController from './controllers/StringController';\nimport
NumberController from './controllers/NumberController';\nimport NumberControllerBox from
 './controllers/NumberControllerBox';\nimport NumberControllerSlider from
 './controllers/NumberControllerSlider';\nimport FunctionController from './controllers/FunctionController';\nimport
ColorController from './controllers/ColorController';\nimport domImport from './dom/dom';\nimport GUIImport
from './gui/GUI';\n\nexport const color = {\n Color: Color,\n math: math,\n interpret: interpret\n};\n\nexport
const controllers = {\n Controller: Controller,\n BooleanController: BooleanController,\n OptionController:
OptionController,\n StringController: StringController,\n NumberController: NumberController,\n
NumberControllerBox: NumberControllerBox,\n NumberControllerSlider: NumberControllerSlider,\n
FunctionController: FunctionController,\n ColorController: ColorController\n};\n\nexport const dom = { dom:
domImport }; \n\nexport const gui = { GUI: GUIImport }; \n\nexport const GUI = GUIImport;\n\nexport default {\n
color,\n controllers,\n dom,\n gui,\n GUI\n};\n\n,\"/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
 * \n\nexport default function(color,
forceCSSHex) {\n const colorFormat = color.__state.conversionName.toString();\n const r =
Math.round(color.r);\n const g = Math.round(color.g);\n const b = Math.round(color.b);\n const a = color.a;\n
const h = Math.round(color.h);\n const s = color.s.toFixed(1);\n const v = color.v.toFixed(1);\n\n if (forceCSSHex
|| (colorFormat === 'THREE_CHAR_HEX') || (colorFormat === 'SIX_CHAR_HEX')) {\n let str =
color.hex.toString(16);\n while (str.length < 6) {\n str = '0' + str;\n }\n return '#' + str;\n } else if
(colorFormat === 'CSS_RGB') {\n return 'rgb(' + r + ',' + g + ',' + b + ')';\n } else if (colorFormat ===
'CSS_RGBA') {\n return 'rgba(' + r + ',' + g + ',' + b + ',' + a + ')';\n } else if (colorFormat === 'HEX') {\n
return '0x' + color.hex.toString(16);\n } else if (colorFormat === 'RGB_ARRAY') {\n return '[' + r + ',' + g + ',' + b +
']';\n } else if (colorFormat === 'RGBA_ARRAY') {\n return '[' + r + ',' + g + ',' + b + ',' + a +
']';\n } else if (colorFormat === 'RGB_OBJ') {\n return '{r:' + r + ',g:' + g + ',b:' + b + '}';\n } else if (colorFormat
=== 'RGBA_OBJ') {\n return '{r:' + r + ',g:' + g + ',b:' + b + ',a:' + a + '}';\n } else if (colorFormat ===
'HSV_OBJ') {\n return '{h:' + h + ',s:' + s + ',v:' + v + '}';\n } else if (colorFormat === 'HSVA_OBJ') {\n
return '{h:' + h + ',s:' + s + ',v:' + v + ',a:' + a + '}';\n }\n}\n\nreturn 'unknown format';\n}\n\n,\"/*\n * dat-gui JavaScript
Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative
Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n\nconst ARR_EACH = Array.prototype.forEach;\nconst
ARR_SLICE = Array.prototype.slice;\n\n/*\n * Band-aid methods for things that should be a lot easier in

```

```

JavaScript.\n * Implementation and structure inspired by underscore.js\n *
http://documentcloud.github.com/underscore/\n *\n\nconst Common = {\n BREAK: {},\n\n extend:
function(target) {\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj)
? Object.keys(obj) : [];\n keys.forEach(function(key) {\n if (!this.isUndefined(obj[key])) {\n
target[key] = obj[key];\n }\n }.bind(this));\n }, this);\n\n return target;\n },\n\n defaults: function(target)
{\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj) ?
Object.keys(obj) : [];\n keys.forEach(function(key) {\n if (this.isUndefined(target[key])) {\n
target[key]
= obj[key];\n }\n }.bind(this));\n }, this);\n\n return target;\n },\n\n compose: function() {\n const
toCall = ARR_SLICE.call(arguments);\n return function() {\n let args = ARR_SLICE.call(arguments);\n
for (let i = toCall.length - 1; i >= 0; i--) {\n args = [toCall[i].apply(this, args)];\n }\n return
args[0];\n
};\n },\n\n each: function(obj, itr, scope) {\n if (!obj) {\n return;\n }\n\n if (ARR_EACH && obj.forEach
&& obj.forEach === ARR_EACH) {\n obj.forEach(itr, scope);\n } else if (obj.length === obj.length + 0) { // Is
number but not NaN\n let key;\n let l;\n for (key = 0, l = obj.length; key < l; key++) {\n if (key in obj
&& itr.call(scope, obj[key], key) === this.BREAK) {\n return;\n }\n }\n } else {\n for (const key
in obj) {\n if (itr.call(scope, obj[key], key) === this.BREAK) {\n return;\n }\n }\n }\n },\n\n
defer: function(fnc) {\n setTimeout(fnc, 0);\n },\n\n // if the function is called repeatedly, wait until threshold
passes until we execute the function\n debounce: function(func, threshold, callImmediately) {\n let timeout;\n
return function() {\n const obj = this;\n const args = arguments;\n function delayed() {\n timeout =
null;\n if (!callImmediately) func.apply(obj, args);\n }\n\n const callNow = callImmediately ||
!timeout;\n\n clearTimeout(timeout);\n timeout = setTimeout(delayed, threshold);\n\n if (callNow) {\n
func.apply(obj, args);\n }\n },\n\n toArray: function(obj) {\n if (obj.toArray) return obj.toArray();\n
return ARR_SLICE.call(obj);\n },\n\n isUndefined: function(obj) {\n return obj === undefined;\n },\n\n
isNull: function(obj) {\n return obj === null;\n },\n\n isNaN: function(obj) {\n return isNaN(obj);\n },\n\n
isArray: Array.isArray || function(obj) {\n return obj.constructor === Array;\n },\n\n isObject: function(obj)
{\n return obj === Object(obj);\n },\n\n isNumber: function(obj) {\n return obj === obj + 0;\n },\n\n
isString: function(obj) {\n return obj === obj + '';\n
},\n\n isBoolean: function(obj) {\n return obj === false || obj === true;\n },\n\n isFunction: function(obj)
{\n return Object.prototype.toString.call(obj) === '[object Function]';\n }\n\n};\n\n\nexport default Common;\n"}\n\n *
dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team,
Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport toString from './toString';\nimport common from
'./utils/common';\n\nconst INTERPRETATIONS = {\n // Strings\n litmus: common.isString,\n conversions:
{\n THREE_CHAR_HEX: {\n read: function(original) {\n const test = original.match(/^#[(A-F0-9)
]{3}/i);\n if (test === null) {\n return false;\n }\n\n return {\n space: 'HEX',\n hex: parseInt(\n
'0x' +\n test[1].toString() +\n test[1].toString() +\n test[2].toString() + test[2].toString() +\n
test[3].toString() + test[3].toString(),\n 0)\n };,\n\n write: toString\n },\n\n SIX_CHAR_HEX: {\n read:
function(original) {\n const test = original.match(/^#[(A-F0-9)]{6}/i);\n if (test === null) {\n return
false;\n }\n\n return {\n space: 'HEX',\n hex: parseInt('0x' + test[1].toString(), 0)\n };,\n\n write:
toString\n },\n\n CSS_RGB: {\n read: function(original) {\n const test =
original.match(/^rgb\(\(\s*(.+)\s*,\s*(.+)\s*,\s*(.+)\s*\)/);,\n if (test === null) {\n return false;\n
}\n\n return {\n space: 'RGB',\n r: parseFloat(test[1]),\n
g: parseFloat(test[2]),\n b: parseFloat(test[3])\n };,\n\n write: toString\n },\n\n CSS_RGBA: {\n read:
function(original) {\n const test =
original.match(/^rgba\(\(\s*(.+)\s*,\s*(.+)\s*,\s*(.+)\s*,\s*(.+)\s*\)/);,\n if (test === null) {\n return
false;\n }\n\n return {\n space: 'RGB',\n r: parseFloat(test[1]),\n g:
parseFloat(test[2]),\n b: parseFloat(test[3]),\n a: parseFloat(test[4])\n };,\n\n write:

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toString\n }\n }\n },\n\n // Numbers\n {\n litmus: common.isNumber,\n\n conversions: {\n\n HEX: {\n read: function(original) {\n return {\n space: 'HEX',\n hex: original,\n conversionName: 'HEX'\n };\n },\n\n write: function(color) {\n return color.hex;\n }\n }\n\n }\n\n }\n\n // Arrays\n {\n litmus: common.isArray,\n\n conversions: {\n\n RGB_ARRAY: {\n read: function(original) {\n if (original.length !== 3) {\n return false;\n }\n return {\n space: 'RGB',\n r: original[0],\n g: original[1],\n b: original[2]\n };\n },\n\n write: function(color) {\n return [color.r, color.g, color.b];\n }\n },\n\n RGBA_ARRAY: {\n read: function(original) {\n if (original.length !== 4) return false;\n return {\n space: 'RGB',\n r: original[0],\n g: original[1],\n b: original[2],\n a: original[3]\n };\n },\n\n write: function(color) {\n return [color.r, color.g, color.b, color.a];\n }\n }\n }\n\n }\n\n // Objects\n {\n litmus: common.isObject,\n\n conversions: {\n\n RGBA_OBJ: {\n read: function(original) {\n if (common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n common.isNumber(original.b) &&\n common.isNumber(original.a)) {\n return {\n space: 'RGB',\n r: original.r,\n g: original.g,\n b: original.b,\n a: original.a\n };\n }\n return false;\n },\n\n write: function(color) {\n return {\n r: color.r,\n g: color.g,\n b: color.b,\n a: color.a\n };\n }\n },\n\n RGB_OBJ: {\n read: function(original) {\n if (common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n common.isNumber(original.b)) {\n return {\n space: 'RGB',\n r: original.r,\n g: original.g,\n b: original.b\n };\n }\n return false;\n },\n\n write: function(color) {\n return {\n r: color.r,\n g: color.g,\n b: color.b\n };\n }\n },\n\n HSVA_OBJ: {\n read: function(original) {\n if (common.isNumber(original.h) &&\n common.isNumber(original.s) &&\n common.isNumber(original.v) &&\n common.isNumber(original.a)) {\n return {\n space: 'HSV',\n h: original.h,\n s: original.s,\n v: original.v,\n a: original.a\n };\n }\n return false;\n },\n\n write: function(color) {\n return {\n h: color.h,\n s: color.s,\n v: color.v,\n a: color.a\n };\n }\n },\n\n HSV_OBJ: {\n read: function(original) {\n if (common.isNumber(original.h) &&\n common.isNumber(original.s) &&\n common.isNumber(original.v)) {\n return {\n space: 'HSV',\n h: original.h,\n s: original.s,\n v: original.v\n };\n }\n return false;\n },\n\n write: function(color) {\n return {\n h: color.h,\n s: color.s,\n v: color.v\n };\n }\n }\n }\n\n }\n};\n\nlet result;\nlet toReturn;\n\nconst interpret = function() {\n toReturn = false;\n\n const original = arguments.length > 1 ? common.toArray(arguments) : arguments[0];\n\n common.each(INTERPRETATIONS, function(family) {\n if (family.litmus(original)) {\n common.each(family.conversions, function(conversion, conversionName) {\n result = conversion.read(original);\n\n if (toReturn === false && result !== false) {\n toReturn = result;\n result.conversionName = conversionName;\n result.conversion = conversion;\n return common.BREAK;\n }\n });\n }\n });\n\n return common.BREAK;\n};\n\nreturn toReturn;\n};\n\nexport default interpret;\n", "/*\n * dat-gui JavaScript Controller Library\n *\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n */\n\nlet tmpComponent;\n\nconst ColorMath = {\n hsv_to_rgb: function(h, s, v) {\n const hi = Math.floor(h / 60) % 6;\n const f = h / 60 - Math.floor(h / 60);\n const p = v * (1.0 - s);\n const q = v * (1.0 - (f * s));\n const t = v * (1.0 - ((1.0 - f) * s));\n const c = [\n [v, t, p],\n [q, v, p],\n [p, v, t],\n [p, q, v],\n [t, p, v],\n [v, p, q]\n][hi];\n return {\n r: c[0] * 255,\n g: c[1] * 255,\n b: c[2] * 255\n };\n },\n\n rgb_to_hsv: function(r, g, b) {\n const min = Math.min(r, g, b);\n const max = Math.max(r, g, b);\n const delta = max - min;\n let h;\n let s;\n\n if (max !== 0) {\n s =\n
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= delta / max;\n } else {\n return {\n h: NaN,\n s: 0,\n v: 0\n };\n }\n\n if (r === max) {\n h = (g - b) / delta;\n } else if (g === max) {\n h = 2 + (b - r) / delta;\n } else {\n h = 4 + (r - g) / delta;\n }\n\n h /= 6;\n if (h < 0) {\n h += 1;\n }\n\n return {\n h: h * 360,\n s: s,\n v: max / 255\n };\n },\n\n rgb_to_hex: function(r, g, b) {\n let hex = this.hex_with_component(0, 2, r);\n hex = this.hex_with_component(hex, 1, g);\n hex = this.hex_with_component(hex, 0, b);\n return hex;\n },\n\n component_from_hex: function(hex, componentIndex) {\n return (hex >> (componentIndex * 8)) & 0xFF;\n },\n\n hex_with_component:\n\n function(hex, componentIndex, value) {\n return value << (tmpComponent = componentIndex * 8) | (hex & ~\n(0xFF << tmpComponent));\n }\n};\n\nexport default ColorMath;\n", "/*\n * dat-gui JavaScript Controller\nLibrary\n * http://code.google.com/p/dat-gui/\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\ncompliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport interpret from './interpret';\nimport math from './math';\nimport colorToString from './toString';\nimport common from './utils/common';\n\nclass Color {\n constructor() {\n this.__state = interpret.apply(this, arguments);\n\n if (this.__state === false) {\n throw new\nError('Failed to interpret color arguments');\n }\n\n this.__state.a = this.__state.a || 1;\n }\n\n toString() {\n return colorToString(this);\n }\n\n toHexString() {\n return colorToString(this, true);\n }\n\n toOriginal() {\n return\nthis.__state.conversion.write(this);\n }\n\n defineRGBComponent(target, component,\ncomponentHexIndex) {\n Object.defineProperty(target, component, {\n get: function() {\n if\n(this.__state.space === 'RGB') {\n return this.__state[component];\n }\n\n Color.recalculateRGB(this,\ncomponent, componentHexIndex);\n\n return this.__state[component];\n },\n\n set: function(v) {\n if\n(this.__state.space !== 'RGB') {\n Color.recalculateRGB(this, component, componentHexIndex);\n\n this.__state.space = 'RGB';\n }\n\n this.__state[component] = v;\n }\n});\n\n defineHSVComponent(target, component) {\n Object.defineProperty(target, component, {\n get: function() {\n if\n(this.__state.space === 'HSV') {\n return this.__state[component];\n }\n\n Color.recalculateHSV(this);\n\n return\nthis.__state[component];\n },\n\n set: function(v) {\n if\n(this.__state.space !== 'HSV') {\n Color.recalculateHSV(this);\n\n this.__state.space = 'HSV';\n }\n\n this.__state[component] = v;\n }\n});\n\n Color.recalculateRGB = function(color, component, componentHexIndex) {\n if (color.__state.space\n=== 'HEX') {\n color.__state[component] = math.component_from_hex(color.__state.hex,\ncomponentHexIndex);\n } else if (color.__state.space === 'HSV') {\n common.extend(color.__state,\nmath.hsv_to_rgb(color.__state.h, color.__state.s, color.__state.v));\n } else {\n throw new Error('Corrupted color\nstate');\n }\n }\n\n Color.recalculateHSV = function(color) {\n const result = math.rgb_to_hsv(color.r, color.g,\ncolor.b);\n\n common.extend(color.__state,\n{\n s: result.s,\n v: result.v\n });\n\n if\n(!common.isNaN(result.h)) {\n color.__state.h = result.h;\n } else if (common.isUndefined(color.__state.h)) {\n color.__state.h\n= 0;\n }\n }\n\n Color.COMPONENTS = ['r', 'g', 'b', 'h', 's', 'v', 'hex', 'a'];\n\n defineRGBComponent(Color.prototype, 'r', 2);\n defineRGBComponent(Color.prototype, 'g', 1);\n defineRGBComponent(Color.prototype, 'b',\n0);\n\n defineHSVComponent(Color.prototype, 'h');\n defineHSVComponent(Color.prototype,\n's');\n defineHSVComponent(Color.prototype, 'v');\n\n Object.defineProperty(Color.prototype, 'a', {\n get: function()\n{\n return this.__state.a;\n },\n\n set: function(v) {\n this.__state.a = v;\n }\n });\n\n Object.defineProperty(Color.prototype, 'hex', {\n get: function() {\n if\n(!this.__state.space !== 'HEX')\n{\n this.__state.hex = math.rgb_to_hex(this.r, this.g, this.b);\n }\n\n return this.__state.hex;\n },\n\n set:\nfunction(v) {\n this.__state.space = 'HEX';\n this.__state.hex = v;\n }\n });\n\nexport default Color;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui/\n * Copyright 2011 Data Arts Team,\nGoogle Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\nuse this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

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http://www.apache.org/licenses/LICENSE-2.0\n *\n\n/**\n * @class An \"abstract\" class that represents a given
property of an object.\n *\n * @param {Object} object The object to be manipulated\n * @param {string} property
The name of the property to be manipulated\n */\n\nclass Controller {\n constructor(object, property) {\n
this.initialValue = object[property];\n\n /**\n * Those who extend this class will put their DOM elements in
here.\n * @type {DOMElement}\n */\n this.domElement = document.createElement('div');\n\n /**\n *
The object to manipulate\n * @type {Object}\n */\n this.object = object;\n\n /**\n * The name of the
property to manipulate\n * @type {String}\n */\n this.property = property;\n\n /**\n *
The function to be called on change.\n * @type {Function}\n * @ignore\n */\n this.__onChange =
undefined;\n\n /**\n * The function to be called on finishing change.\n * @type {Function}\n * @ignore\n
*/\n this.__onFinishChange = undefined;\n }\n\n /**\n * Specify that a function fire every time someone
changes the value with\n * this Controller.\n *\n * @param {Function} fnc This function will be called
whenever the value\n * is modified via this Controller.\n * @returns {Controller} this\n */\n onChange(fnc) {\n
this.__onChange = fnc;\n return this;\n }\n\n /**\n * Specify that a function fire every time someone
\"finishes\" changing\n * the value with this Controller. Useful for values that change\n * incrementally like
numbers or strings.\n *\n * @param {Function} fnc This function will be called whenever\n * someone
\"finishes\" changing the value via this Controller.\n * @returns {Controller} this\n */\n onFinishChange(fnc) {\n
this.__onFinishChange = fnc;\n return this;\n }\n\n /**\n * Change the value of
<code>object[property]</code>\n *\n * @param {Object} newValue The new value of
<code>object[property]</code>\n */\n setValue(newValue) {\n this.object[this.property] = newValue;\n if
(this.__onChange) {\n this.__onChange.call(this, newValue);\n }\n\n this.updateDisplay();\n return this;\n
}\n\n /**\n * Gets the value of <code>object[property]</code>\n *\n * @returns {Object} The current value of
<code>object[property]</code>\n */\n getValue() {\n return this.object[this.property];\n }\n\n /**\n *
Refreshes the visual display of a Controller in order to keep sync\n * with the object's current value.\n * @returns
{Controller} this\n */\n updateDisplay() {\n return this;\n }\n\n /**\n * @returns {Boolean} true if the value
has deviated from initialValue\n */\n isModified() {\n return this.initialValue !== this.getValue();\n
}\n}\n\nexport default Controller;\n", /**\n * dat-gui JavaScript Controller Library\n */

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<http://code.google.com/p/dat-gui/> \*\n \* Copyright 2011 Data Arts Team, Google Creative Lab\n \* Licensed
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License.\n \* You may obtain a copy of the License at\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n

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import common from '../utils/common';\nconst EVENT_MAP = {\n HTMLEvents: ['change'],\n MouseEvents: ['click', 'mousemove', 'mousedown', 'mouseup', 'mouseover'],\n KeyboardEvents:
['keydown']\n};\nconst EVENT_MAP_INV = {};\ncommon.each(EVENT_MAP, function(v, k) {\n
common.each(v, function(e) {\n EVENT_MAP_INV[e] = k;\n});\n});\nconst CSS_VALUE_PIXELS =
/((\\d+(\\.\\d+)?))px;\nfunction cssValueToPixels(val) {\n if (val === '0' || common.isUndefined(val)) {\n return
0;\n }\n\n const match = val.match(CSS_VALUE_PIXELS);\n\n if (!common.isNull(match)) {\n
return parseFloat(match[1]);\n }\n\n // TODO ...ems? %?\n return 0;\n}\n\n/**\n * @namespace\n *
@member dat.dom\n */\nconst dom = {\n\n /**\n *\n * @param elem\n * @param selectable\n */\n makeSelectable: function(elem, selectable) {\n if (elem === undefined || elem.style === undefined) return;\n
elem.onselectstart = selectable ? function() {\n return false;\n } : function() {\n };\n\n elem.style.MozUserSelect = selectable ? 'auto' : 'none';\n elem.style.KhtmlUserSelect = selectable ? 'auto' :
'none';\n elem.unselectable = selectable ? 'on' : 'off';\n },\n\n /**\n *\n * @param elem\n * @param
horizontal\n * @param vert\n */\n makeFullscreen: function(elem, hor, vert) {\n let vertical = vert;\n let
horizontal = hor;\n\n if (common.isUndefined(horizontal)) {\n horizontal = true;\n }\n\n if
(common.isUndefined(vertical)) {\n vertical = true;\n }\n\n elem.style.position = 'absolute';\n\n if
(horizontal) {\n elem.style.left = 0;\n elem.style.right = 0;\n }\n\n if (vertical) {\n elem.style.top =
0;\n elem.style.bottom = 0;\n }\n },\n\n /**\n *\n * @param elem\n * @param eventType\n * @param
params\n */\n fakeEvent: function(elem, eventType, pars, aux) {\n const params = pars || {};\n const
className = EVENT_MAP_INV[eventType];\n if (!className) {\n throw new Error('Event type ' +

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eventType + ' not supported.');
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 }
 const evt = document.createEvent(className);
 switch (className) {
 case 'MouseEvents':
 const clientX = params.x || params.clientX || 0;
 const clientY =
 params.y || params.clientY || 0;
 evt.initMouseEvent(eventType, params.bubbles || false,
 params.cancelable || true, window, params.clickCount || 1,
 0, // screen X
 0, // screen Y
 clientX, // client X
 clientY, // client
 Y
 false, false, false, false, 0, null);
 break;
 case 'KeyboardEvents':
 const
 init = evt.initKeyboardEvent || evt.initKeyEvent; // webkit || moz
 common.defaults(params, {
 cancelable: true,
 ctrlKey: false,
 altKey: false,
 shiftKey: false,
 metaKey: false,
 keyCode: undefined,
 charCode: undefined
 });
 init(eventType, params.bubbles || false,
 params.cancelable, window,
 params.ctrlKey, params.altKey,
 params.shiftKey,
 params.metaKey,
 params.keyCode, params.charCode);
 break;
 }
 default:
 {
 evt.initEvent(eventType, params.bubbles || false, params.cancelable || true);
 break;
 }
 }
 common.defaults(evt, aux);
 elem.dispatchEvent(evt);
},\n\n /**\n *\n * @param elem\n * @param
event\n
* @param func\n * @param bool\n */
bind: function(elem, event, func, newBool) {
 const bool =
 newBool || false;
 if (elem.addEventListener) {
 elem.addEventListener(event, func, bool);
 } else if
 (elem.attachEvent) {
 elem.attachEvent('on' + event, func);
 }
 return dom;
},\n\n /**\n *\n *
@param elem\n * @param event\n * @param func\n * @param bool\n */
unbind: function(elem, event,
func, newBool) {
 const bool = newBool || false;
 if (elem.removeEventListener) {
 elem.removeEventListener(event, func, bool);
 } else if
 (elem.detachEvent) {
 elem.detachEvent('on' + event,
 func);
 }
 return dom;
},\n\n /**\n *\n * @param elem\n * @param className\n */
addClass:
function(elem, className) {
 if (elem.className === undefined) {
 elem.className = className;
 } else
 if (elem.className !== className) {
 const classes = elem.className.split(/ +/);
 if
 (classes.indexOf(className)
 === -1) {
 classes.push(className);
 elem.className = classes.join(' ').replace(/^\s+/, "").replace(/\s+$/,
 "");
 }
 }
 return dom;
},\n\n /**\n *\n * @param elem\n * @param className\n */
removeClass:
function(elem, className) {
 if (className) {
 if (elem.className === className) {
 elem.removeAttribute('class');
 } else {
 const classes = elem.className.split(/ +/);
 const index =
 classes.indexOf(className);
 if (index !== -1) {
 classes.splice(index, 1);
 elem.className =
 classes.join(' ');
 }
 }
 } else {
 elem.className = undefined;
 }
 return dom;
},\n\n
hasClass: function(elem, className) {
 return new RegExp('(?:^|\\s+)' + className +
 '(?:\\s+$)').test(elem.className) || false;
},\n\n /**\n *\n * @param elem\n */
getWidth: function(elem)
{
 const style = getComputedStyle(elem);
 return cssValueToPixels(style['border-left-width']) +
 cssValueToPixels(style['border-right-width']) +
 cssValueToPixels(style['padding-left']) +
 cssValueToPixels(style['padding-right']) +
 cssValueToPixels(style.width);
},\n\n /**\n *\n * @param elem\n */
getHeight: function(elem) {
 const
 style = getComputedStyle(elem);
 return cssValueToPixels(style['border-top-width']) +
 cssValueToPixels(style['border-bottom-width']) +
 cssValueToPixels(style['padding-top']) +
 cssValueToPixels(style['padding-bottom']) +
 cssValueToPixels(style.height);
},\n\n /**\n *\n * @param
el\n */
getOffset: function(el) {
 let elem = el;
 const offset = { left: 0, top: 0 };
 if (elem.offsetParent)
 {
 do {
 offset.left += elem.offsetLeft;
 offset.top += elem.offsetTop;
 elem =
 elem.offsetParent;
 } while (elem);
 }
 return offset;
},\n\n //
http://stackoverflow.com/posts/2684561/revisions\n
/**\n *\n * @param elem\n */
isActive: function(elem) {
 return elem === document.activeElement &&
 (elem.type || elem.href);
}\n\n};\n\nexport default dom;
",\n\n /**\n *\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the "License");\n *\n * you may not use this file except in compliance with the
License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n

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*/\n\nimport Controller from './Controller';\nimport dom from './dom/dom';\n\n/**\n * @class Provides a checkbox
input to alter the boolean property of an object.\n *\n * @extends dat.controllers.Controller\n *\n * @param
{Object} object The object to be manipulated\n *\n * @param {string} property The name of the property to be
manipulated\n */\n\nclass BooleanController extends Controller {\n constructor(object,
 property) {\n super(object, property);\n\n const _this = this;\n this.__prev = this.getValue();\n\n this.__checkbox = document.createElement('input');\n this.__checkbox.setAttribute('type', 'checkbox');\n\n function onChange() {\n _this.setValue(!_this.__prev);\n }\n\n dom.bind(this.__checkbox, 'change',
 onChange, false);\n\n this.domElement.appendChild(this.__checkbox);\n\n // Match original value\n this.updateDisplay();\n }\n\n setValue(v) {\n const toReturn = super.setValue(v);\n if (this.__onFinishChange)
 {\n this.__onFinishChange.call(this, this.getValue());\n }\n this.__prev = this.getValue();\n return
 toReturn;\n }\n\n updateDisplay() {\n if (this.getValue() === true) {\n this.__checkbox.setAttribute('checked',
 'checked');\n this.__checkbox.checked = true;\n this.__prev = true;\n } else {\n this.__checkbox.checked
 = false;\n this.__prev = false;\n }\n\n return super.updateDisplay();\n }\n}\n\nexport default BooleanController;\n\n", "/*\n * dat-gui JavaScript Controller Library\n *\n
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the "License");\n *\n * you may not use this file except in compliance with the
License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*/\n\nimport Controller from './Controller';\nimport dom from './dom/dom';\nimport common from
'./utils/common';\n\n/**\n * @class Provides a select input to alter the property of an object, using a\n *\n * list of
accepted values.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object The object to be
manipulated\n *\n * @param {string} property The name of the property to be manipulated\n *\n * @param
{Object|string[]} options A map of labels to acceptable values, or\n *\n * a list of acceptable string values.\n */\n\nclass
OptionController extends Controller
{\n constructor(object, property, opts) {\n super(object, property);\n\n let options = opts;\n\n const _this =
 this;\n\n /**\n * The drop down menu\n *\n * @ignore\n */\n this.__select =
 document.createElement('select');\n\n if (common.isArray(options)) {\n const map = {};\n\n common.each(options, function(element) {\n map[element] = element;\n });\n options = map;\n }\n\n common.each(options, function(value, key) {\n const opt = document.createElement('option');\n opt.innerHTML = key;\n opt.setAttribute('value', value);\n _this.__select.appendChild(opt);\n });\n\n //
 Acknowledge original value\n this.updateDisplay();\n\n dom.bind(this.__select, 'change', function() {\n const
 desiredValue = this.options[this.selectedIndex].value;\n _this.setValue(desiredValue);\n });\n\n this.domElement.appendChild(this.__select);\n }\n\n setValue(v) {\n const toReturn = super.setValue(v);\n\n if (this.__onFinishChange) {\n this.__onFinishChange.call(this, this.getValue());\n }\n\n return toReturn;\n }\n\n updateDisplay() {\n if (dom.isActive(this.__select)) return this; // prevent number from updating if user is
 trying to manually update\n this.__select.value = this.getValue();\n return super.updateDisplay();\n }\n}\n\nexport default OptionController;\n\n", "/*\n * dat-gui JavaScript Controller Library\n *\n
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the "License");\n *\n * you may not use this file except in compliance with the
License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*/\n\nimport Controller from './Controller';\nimport dom from './dom/dom';\n\n/**\n * @class Provides a text input
to alter the string property of an object.\n *\n * @extends dat.controllers.Controller\n *\n * @param
{Object} object The object to be manipulated\n *\n * @param {string} property The name of the property to be
manipulated\n */\n\nclass StringController extends Controller {\n constructor(object, property) {\n super(object,
 property);\n\n const _this = this;\n\n function onChange() {\n _this.setValue(_this.__input.value);\n }\n\n function onBlur() {\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this,
 _this.getValue());\n }\n }\n\n this.__input = document.createElement('input');\n this.__input.setAttribute('type', 'text');\n\n dom.bind(this.__input, 'keyup', onChange);\n dom.bind(this.__input,
 'change', onChange);\n dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'keydown', function(e)

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{\n if (e.keyCode === 13) {\n this.blur();\n }\n});\n\n this.updateDisplay();\n\n
this.domElement.appendChild(this.__input);\n }\n\n updateDisplay() {\n // Stops the caret from moving on
account of:\n // keyup -> setValue -> updateDisplay\n if (!dom.isActive(this.__input)) {\n this.__input.value
= this.getValue();\n }\n return super.updateDisplay();\n }\n}\n\nexport default StringController;\n", "/*\n * dat-
gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team,
Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller from './Controller';\nimport common from
'./utils/common';\n\nfunction numDecimals(x) {\n const _x = x.toString();\n if (_x.indexOf('.') > -1) {\n return
_x.length - _x.indexOf('.') - 1;\n }\n return 0;\n}\n\n/**\n * @class Represents a given property of an object that
is a number.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object
The object to be manipulated\n *\n * @param {string} property The name of the property to be manipulated\n *\n
* @param {Object} [params] Optional parameters\n *\n * @param {Number} [params.min] Minimum allowed value\n *\n
* @param {Number} [params.max] Maximum allowed value\n *\n * @param {Number} [params.step] Increment by
which to change value\n *\n\nclass NumberController extends Controller {\n constructor(object, property, params)
{\n super(object, property);\n\n const _params = params || {};\n\n this.__min = _params.min;\n this.__max =
_params.max;\n this.__step = _params.step;\n\n if (common.isUndefined(this.__step)) {\n if (this.initialValue
=== 0) {\n this.__impliedStep = 1; // What are we, psychics?\n } else {\n // Hey Doug, check this out.\n
 this.__impliedStep = Math.pow(10, Math.floor(Math.log(Math.abs(this.initialValue)) / Math.LN10)) / 10;\n
 }\n } else {\n this.__impliedStep = this.__step;\n }\n\n this.__precision =
numDecimals(this.__impliedStep);\n\n }\n\n setValue(v) {\n let _v = v;\n\n if (this.__min !== undefined && _v < this.__min) {\n _v =
this.__min;\n } else if (this.__max !== undefined && _v > this.__max) {\n _v = this.__max;\n }\n\n if
(this.__step !== undefined && _v % this.__step !== 0) {\n _v = Math.round(_v / this.__step) * this.__step;\n
 }\n\n return super.setValue(_v);\n }\n\n /**\n * Specify a minimum value for <code>object[property]</code>.\n
 *\n * @param {Number} minValue The minimum value for\n * <code>object[property]</code>\n * @returns
{dat.controllers.NumberController} this\n *\n * ^\n * min(minValue) {\n this.__min = minValue;\n return this;\n
 }\n\n /**\n * Specify a maximum value for <code>object[property]</code>.\n *\n * @param {Number}
maxValue The maximum value for\n * <code>object[property]</code>\n * @returns
{dat.controllers.NumberController} this\n *\n * ^\n * max(maxValue) {\n this.__max = maxValue;\n return
this;\n }\n\n /**\n * Specify a step value that dat.controllers.NumberController\n * increments by.\n *\n
 * @param {Number} stepValue The step value for\n * dat.controllers.NumberController\n * @default if minimum
and maximum specified increment is 1% of the\n * difference otherwise stepValue is 1\n * @returns
{dat.controllers.NumberController} this\n *\n * ^\n * step(stepValue) {\n this.__step = stepValue;\n
this.__impliedStep = stepValue;\n this.__precision = numDecimals(stepValue);\n return this;\n }\n}\n\n\nexport
default NumberController;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n
*\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport NumberController from
'./NumberController';\nimport dom from './dom/dom';\nimport common from './utils/common';\n\nfunction
roundToDecimal(value, decimals) {\n const tenTo = Math.pow(10, decimals);\n return Math.round(value * tenTo)
/ tenTo;\n}\n\n/**\n * @class Represents a given property of an object that is a number and\n * provides an input
element with which to manipulate it.\n *\n * @extends dat.controllers.Controller\n *\n * @extends
dat.controllers.NumberController\n *\n * @param {Object} object The object to be manipulated\n *\n * @param
{string} property The name of the property to be manipulated\n *\n * @param {Object} [params] Optional parameters\n
*\n * @param {Number} [params.min] Minimum allowed value\n *\n * @param {Number} [params.max] Maximum
allowed value\n *\n * @param {Number} [params.step] Increment by which to change value\n *\n\nclass
NumberControllerBox extends NumberController {\n constructor(object, property, params) {\n super(object,

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property, params);\n\n this.__truncationSuspended = false;\n\n
 const _this = this;\n\n /**\n * {Number} Previous mouse y position\n * @ignore\n */\n let prevY;\n\n function onChange() {\n const attempted = parseFloat(_this.__input.value);\n if (!common.isNaN(attempted))\n {\n _this.setValue(attempted);\n }\n }\n\n function onFinish() {\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n function onBlur() {\n onFinish();\n }\n\n function onMouseDrag(e) {\n const diff = prevY - e.clientY;\n _this.setValue(_this.getValue() + diff *
 _this.__impliedStep);\n prevY = e.clientY;\n }\n\n function onMouseUp() {\n dom.unbind(window,
 'mousemove', onMouseDrag);\n dom.unbind(window, 'mouseup', onMouseUp);\n onFinish();\n }\n\n function onMouseDown(e) {\n dom.bind(window, 'mousemove', onMouseDrag);\n dom.bind(window,
 'mouseup', onMouseUp);\n prevY = e.clientY;\n }\n\n
 this.__input = document.createElement('input');\n this.__input.setAttribute('type', 'text');\n // Makes it so
 manually specified values are not truncated.\n\n dom.bind(this.__input, 'change', onChange);\n
 dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'mousedown', onMouseDown);\n
 dom.bind(this.__input, 'keydown', function(e) {\n // When pressing enter, you can be as precise as you want.\n
 if (e.keyCode === 13) {\n _this.__truncationSuspended = true;\n this.blur();\n
 _this.__truncationSuspended = false;\n onFinish();\n }\n});\n\n this.updateDisplay();\n\n
 this.domElement.appendChild(this.__input);\n }\n\n updateDisplay() {\n this.__input.value =
 this.__truncationSuspended ? this.getValue() : roundToDecimal(this.getValue(), this.__precision);\n
 return
 super.updateDisplay();\n }\n}\n\nexport default NumberControllerBox;\n"/**\n * dat-gui JavaScript Controller
 Library\n * http://code.google.com/p/dat-gui\n
 *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version
 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport NumberController from
 './NumberController';\nimport dom from './dom/dom';\n\nfunction map(v, i1, i2, o1, o2) {\n return o1 + (o2 - o1) *
 ((v - i1) / (i2 - i1));\n}\n\n/**\n * @class Represents a given property of an object that is a number, contains\n *
 a minimum and maximum, and provides a slider element with which to\n * manipulate it. It should be noted that the
 slider element is made up of\n * <code><div>></code> tags, not the html5\n *
 <code><slider>></code> element.\n *\n * @extends dat.controllers.Controller\n * @extends
 dat.controllers.NumberController\n *\n * @param {Object} object The object to be manipulated\n * @param
 {string} property The name of the property to be manipulated\n * @param {Number} minValue Minimum allowed
 value\n * @param {Number} maxValue Maximum allowed value\n * @param {Number} stepValue Increment by
 which to change value\n */\n\nclass NumberControllerSlider extends NumberController {\n constructor(object,
 property, min, max, step) {\n super(object, property, { min: min, max: max, step: step });\n\n const _this =
 this;\n\n this.__background = document.createElement('div');\n this.__foreground =
 document.createElement('div');\n\n dom.bind(this.__background, 'mousedown', onMouseDown);\n
 dom.bind(this.__background, 'touchstart', onTouchStart);\n\n dom.addClass(this.__background, 'slider');\n
 dom.addClass(this.__foreground, 'slider-fg');\n\n function onMouseDown(e) {\n
 document.activeElement.blur();\n\n dom.bind(window, 'mousemove', onMouseDrag);\n dom.bind(window,
 'mouseup', onMouseUp);\n\n onMouseDrag(e);\n }\n\n function onMouseDrag(e)\n
 {\n e.preventDefault();\n\n const bgRect = _this.__background.getBoundingClientRect();\n\n
 _this.setValue(\n map(e.clientX, bgRect.left, bgRect.right, _this.__min, _this.__max)\n);\n\n return
 false;\n }\n\n function onMouseUp() {\n dom.unbind(window, 'mousemove', onMouseDrag);\n
 dom.unbind(window, 'mouseup', onMouseUp);\n\n if (_this.__onFinishChange) {\n
 _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n function onTouchStart(e) {\n if
 (e.touches.length !== 1) { return; }\n\n dom.bind(window, 'touchmove', onTouchMove);\n dom.bind(window,
 'touchend', onTouchEnd);\n\n onTouchMove(e);\n }\n\n function onTouchMove(e) {\n const clientX =
 e.touches[0].clientX;\n const bgRect = _this.__background.getBoundingClientRect();\n\n _this.setValue(\n
 map(clientX, bgRect.left, bgRect.right, _this.__min, _this.__max)\n);\n }\n\n function onTouchEnd() {\n

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 dom.unbind(window, 'touchmove', onTouchMove);\n dom.unbind(window, 'touchend', onTouchEnd);\n if
 (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n
 this.updateDisplay();\n\n this.__background.appendChild(this.__foreground);\n\n
 this.domElement.appendChild(this.__background);\n }\n\n updateDisplay() {\n const pct = (this.getValue() -
 this.__min) / (this.__max - this.__min);\n this.__foreground.style.width = pct * 100 + '%';\n return
 super.updateDisplay();\n }\n}\n\nexport default NumberControllerSlider;\n", "/*\n * dat-gui JavaScript Controller
 Library\n * http://code.google.com/p/dat-gui/\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n *
 Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
 compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n\nimport Controller
 from './Controller';\nimport dom from './dom/dom';\n\n/**\n * @class Provides a GUI interface to fire a specified
 method, a property of an object.\n * \n * @extends dat.controllers.Controller\n * \n * @param {Object} object The
 object to be manipulated\n * \n * @param {string} property The name of the property to be manipulated\n * \n\nclass
 FunctionController extends Controller {\n constructor(object, property, text) {\n super(object, property);\n\n
 const _this = this;\n\n this.__button = document.createElement('div');\n this.__button.innerHTML = text ===
 undefined ? 'Fire' : text;\n\n dom.bind(this.__button, 'click', function(e) {\n e.preventDefault();\n
 _this.fire();\n return false;\n });\n\n dom.addClass(this.__button, 'button');\n\n
 this.domElement.appendChild(this.__button);\n }\n\n fire() {\n if (this.__onChange) {\n
 this.__onChange.call(this);\n }\n this.getValue().call(this.object);\n if (this.__onFinishChange) {\n
 this.__onFinishChange.call(this, this.getValue());\n }\n }\n}\n\nexport default FunctionController;\n", "/*\n *
 dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui/\n * Copyright 2011 Data Arts Team,
 Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use
 this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n\nimport Controller from './Controller';\nimport dom from
 './dom/dom';\nimport Color from './color/Color';\nimport interpret from './color/interpret';\nimport common from
 './utils/common';\n\n/**\n * @class Represents a given property of an object that is a color.\n * \n * @param {Object}
 object\n * \n * @param {string} property\n * \n\nclass ColorController extends Controller {\n constructor(object,
 property) {\n super(object, property);\n\n this.__color = new Color(this.getValue());\n this.__temp
 = new Color(0);\n\n const _this = this;\n\n this.domElement = document.createElement('div');\n\n
 dom.makeSelectable(this.domElement, false);\n\n this.__selector = document.createElement('div');\n\n
 this.__selector.className = 'selector';\n\n this.__saturation_field = document.createElement('div');\n\n
 this.__saturation_field.className = 'saturation-field';\n\n this.__field_knob = document.createElement('div');\n\n
 this.__field_knob.className = 'field-knob';\n this.__field_knob_border = '2px solid ';\n\n this.__hue_knob =
 document.createElement('div');\n this.__hue_knob.className = 'hue-knob';\n\n this.__hue_field =
 document.createElement('div');\n this.__hue_field.className = 'hue-field';\n\n this.__input =
 document.createElement('input');\n this.__input.type = 'text';\n this.__input_textShadow = '0 1px 1px ';\n\n
 dom.bind(this.__input, 'keydown', function(e) {\n if (e.keyCode === 13) { // on enter\n onBlur.call(this);\n
 }\n });\n\n dom.bind(this.__input, 'blur', onBlur);\n\n dom.bind(this.__selector, 'mousedown', function(/* e
 /) {\n dom\n .addClass(this, 'drag')\n .bind(window, 'mouseup', function(/ e */) {\n
 dom.removeClass(_this.__selector, 'drag');\n });\n });\n\n dom.bind(this.__selector, 'touchstart', function(/* e
 /) {\n dom\n .addClass(this, 'drag')\n .bind(window, 'touchend', function(/ e */) {\n
 dom.removeClass(_this.__selector, 'drag');\n });\n });\n\n const valueField =
 document.createElement('div');\n\n common.extend(this.__selector.style, {\n width: '122px',\n height:
 '102px',\n padding: '3px',\n backgroundColor: '#222',\n boxShadow: '0px 1px 3px rgba(0,0,0,0.3)'\n
 });\n\n common.extend(this.__field_knob.style, {\n position: 'absolute',\n width: '12px',\n height:
 '12px',\n border: this.__field_knob_border + (this.__color.v < 0.5 ? '#fff'
 : '#000'),\n boxShadow: '0px 1px 3px rgba(0,0,0,0.5)',\n borderRadius: '12px',\n zIndex: 1\n });\n\n
 common.extend(this.__hue_knob.style, {\n position: 'absolute',\n width: '15px',\n height: '2px',\n

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borderRight: '4px solid #fff',\n zIndex: 1\n });\n\n common.extend(this.__saturation_field.style, {\n width:
'100px',\n height: '100px',\n border: '1px solid #555',\n marginRight: '3px',\n display: 'inline-block',\n cursor: 'pointer'\n });\n\n common.extend(valueField.style, {\n width: '100%',\n height: '100%',\n background: 'none'\n });\n\n linearGradient(valueField, 'top', 'rgba(0,0,0,0)', '#000');\n\n common.extend(this.__hue_field.style, {\n width: '15px',\n height: '100px',\n border: '1px solid #555',\n cursor: 'ns-resize',\n position: 'absolute',\n top: '3px',\n right: '3px'\n });\n\n hueGradient(this.__hue_field);\n\n common.extend(this.__input.style,
{\n outline: 'none',\n width: '120px',\n textAlign: 'center',\n padding: '4px',\n marginBottom:
'6px',\n color: '#fff',\n border: 0,\n fontWeight: 'bold',\n textShadow: this.__input_textShadow +
'rgba(0,0,0,0.7)'\n });\n\n dom.bind(this.__saturation_field, 'mousedown', fieldDown);\n
dom.bind(this.__saturation_field, 'touchstart', fieldDown);\n\n dom.bind(this.__field_knob, 'mousedown',
fieldDown);\n dom.bind(this.__field_knob, 'touchstart', fieldDown);\n\n dom.bind(this.__hue_field,
'mousedown', fieldDownH);\n dom.bind(this.__hue_field, 'touchstart', fieldDownH);\n\n function fieldDown(e)
{\n setSV(e);\n dom.bind(window, 'mousemove', setSV);\n dom.bind(window, 'touchmove', setSV);\n
dom.bind(window, 'mouseup', fieldUpSV);\n dom.bind(window, 'touchend', fieldUpSV);\n }\n\n function
fieldDownH(e) {\n setH(e);\n dom.bind(window, 'mousemove', setH);\n
 dom.bind(window, 'touchmove', setH);\n dom.bind(window, 'mouseup', fieldUpH);\n dom.bind(window,
'touchend', fieldUpH);\n }\n\n function fieldUpSV() {\n dom.unbind(window, 'mousemove', setSV);\n
dom.unbind(window, 'touchmove', setSV);\n dom.unbind(window, 'mouseup', fieldUpSV);\n
dom.unbind(window, 'touchend', fieldUpSV);\n onFinish();\n }\n\n function fieldUpH() {\n
dom.unbind(window, 'mousemove', setH);\n dom.unbind(window, 'touchmove', setH);\n dom.unbind(window,
'mouseup', fieldUpH);\n dom.unbind(window, 'touchend', fieldUpH);\n onFinish();\n }\n\n function
onBlur() {\n const i = interpret(this.value);\n if (i !== false) {\n __this.__color.__state = i;\n
__this.setValue(__this.__color.toOriginal());\n } else {\n this.value = __this.__color.toString();\n }\n
}\n\n function onFinish() {\n if (__this.__onFinishChange) {\n __this.__onFinishChange.call(__this,
__this.__color.toOriginal());\n }\n }\n\n this.__saturation_field.appendChild(valueField);\n
this.__selector.appendChild(this.__field_knob);\n this.__selector.appendChild(this.__saturation_field);\n
this.__selector.appendChild(this.__hue_field);\n this.__hue_field.appendChild(this.__hue_knob);\n\n
this.domElement.appendChild(this.__input);\n this.domElement.appendChild(this.__selector);\n\n
this.updateDisplay();\n\n function setSV(e) {\n if (e.type.indexOf('touch') === -1) { e.preventDefault(); }\n\n
const fieldRect = __this.__saturation_field.getBoundingClientRect();\n const { clientX, clientY } = (e.touches &&
e.touches[0]) || e;\n let s = (clientX - fieldRect.left) / (fieldRect.right - fieldRect.left);\n let v = 1 - (clientY -
fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n\n if (v > 1) {\n v = 1;\n } else if (v < 0) {\n v =
0;\n }\n\n if (s > 1) {\n s = 1;\n } else\n if (s < 0) {\n s = 0;\n }\n\n __this.__color.v = v;\n __this.__color.s = s;\n\n
__this.setValue(__this.__color.toOriginal());\n\n return false;\n }\n\n function setH(e) {\n if
(e.type.indexOf('touch') === -1) { e.preventDefault(); }\n\n const fieldRect =
__this.__hue_field.getBoundingClientRect();\n const { clientY } = (e.touches && e.touches[0]) || e;\n let h = 1 -
(clientY - fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n\n if (h > 1) {\n h = 1;\n } else if (h < 0)
{\n h = 0;\n }\n\n __this.__color.h = h * 360;\n\n __this.setValue(__this.__color.toOriginal());\n
return false;\n }\n\n updateDisplay() {\n const i = interpret(this.getValue());\n\n if (i !== false) {\n let
mismatch = false;\n\n // Check for mismatch on the interpreted value.\n\n common.each(Color.COMPONENTS, function(component) {\n if (!common.isUndefined(i[component]) &&
!common.isUndefined(this.__color.__state[component])\n &&\n i[component] !== this.__color.__state[component]) {\n mismatch = true;\n return {};\n }\n
break\n }, this);\n\n // If nothing diverges, we keep our previous values\n // for statefulness,\n otherwise we recalculate fresh\n if (mismatch) {\n common.extend(this.__color.__state, i);\n }\n }\n\n
common.extend(this.__temp.__state, this.__color.__state);\n\n this.__temp.a = 1;\n\n const flip = (this.__color.v

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< 0.5 || this.__color.s > 0.5) ? 255 : 0;\n const _flip = 255 - flip;\n\n common.extend(this.__field_knob.style, {\n marginLeft: 100 * this.__color.s - 7 + 'px',\n marginTop: 100 * (1 - this.__color.v) - 7 + 'px',\n backgroundColor: this.__temp.toHexString(),\n border: this.__field_knob_border + 'rgb(' + flip + ',' + flip + ',' + flip + ')'\n });\n\n this.__hue_knob.style.marginTop = (1 - this.__color.h / 360) * 100 + 'px';\n\n this.__temp.s = 1;\n this.__temp.v = 1;\n\n linearGradient(this.__saturation_field, 'left', '#fff', this.__temp.toHexString());\n\n this.__input.value = this.__color.toString();\n\n common.extend(this.__input.style, {\n backgroundColor: this.__color.toHexString(),\n color: 'rgb(' + flip + ',' + flip + ',' + flip + ')',\n textShadow: this.__input_textShadow + 'rgba(' + _flip + ',' + _flip + ',' + _flip + ',.7)'\n });\n\n const vendors = ['-moz-', '-o-', '-webkit-', '-ms-', ''];\n\n function linearGradient(elem, x, a, b) {\n elem.style.background = ";\n common.each(vendors, function(vendor) {\n elem.style.cssText += 'background: ' + vendor + 'linear-gradient(' + x + ',' + a + ' 0%, ' + b + ' 100%);';\n });\n }\n\n function hueGradient(elem) {\n elem.style.background = ";\n elem.style.cssText += 'background: -moz-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -webkit-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -o-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -ms-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n }\n\n export default ColorController;\n ", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *\n const css = {\n load: function(url, indoc) {\n const doc = indoc || document;\n const link = doc.createElement('link');\n link.type = 'text/css';\n link.rel = 'stylesheet';\n link.href = url;\n doc.getElementsByTagName('head')[0].appendChild(link);\n },\n\n inject: function(cssContent, indoc) {\n const doc = indoc || document;\n const injected = document.createElement('style');\n injected.type = 'text/css';\n injected.innerHTML = cssContent;\n const head = doc.getElementsByTagName('head')[0];\n try {\n head.appendChild(injected);\n } catch (e) { // Unable to inject CSS, probably because of a Content Security Policy\n }\n }\n }\n\n export default css;\n ", "const saveDialogContent = `<div id=\"dg-save\" class=\"dg-dialogue\">\n\n Here's the new load parameter for your <code>GUI</code>'s constructor:\n\n <textarea id=\"dg-new-constructor\"></textarea>\n\n <div id=\"dg-save-locally\">\n\n <input id=\"dg-local-storage\" type=\"checkbox\"> Automatically save\n values to <code>localStorage</code> on exit.\n\n <div id=\"dg-local-explain\">The values saved to <code>localStorage</code> will\n override those passed to <code>dat.GUI</code>'s constructor. This makes it\n easier to work incrementally, but <code>localStorage</code> is fragile,\n and your friends may not see the same values you do.\n\n </div>\n\n</div>\n\n</div>`\n\n export default saveDialogContent;\n ", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *\n import OptionController from './OptionController';\n import NumberControllerBox from './NumberControllerBox';\n import NumberControllerSlider from './NumberControllerSlider';\n import StringController from './StringController';\n import FunctionController from './FunctionController';\n import BooleanController from './BooleanController';\n import common from './utils/common';\n\n const ControllerFactory = function(object, property) {\n const initialValue = object[property];\n\n // Providing options?\n if (common.isArray(arguments[2]) || common.isObject(arguments[2])) {\n return new OptionController(object, property, arguments[2]);\n }\n\n // Providing a map?\n if (common.isNumber(initialValue)) {\n // Has min and max? (slider)\n if (common.isNumber(arguments[2]) &&

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common.isNumber(arguments[3])) {\n // has step?\n if (common.isNumber(arguments[4])) {\n return new
NumberControllerSlider(object, property,\n arguments[2], arguments[3], arguments[4]);\n }\n\n
return new NumberControllerSlider(object, property, arguments[2], arguments[3]);\n }\n\n // number
box\n if (common.isNumber(arguments[4])) { // has step\n return new NumberControllerBox(object,
property,\n { min: arguments[2], max: arguments[3], step: arguments[4] });\n }\n return new
NumberControllerBox(object, property, { min: arguments[2], max: arguments[3] });\n }\n\n if
(common.isString(initialValue)) {\n return new StringController(object, property);\n }\n\n if
(common.isFunction(initialValue)) {\n return new FunctionController(object, property, "");\n }\n\n if
(common.isBoolean(initialValue)) {\n return new BooleanController(object, property);\n }\n\n return
null;\n};\n\nexport default ControllerFactory;\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\nfunction
requestAnimationFrame(callback) {\n setTimeout(callback, 1000 / 60);\n}\n\nexport default
window.requestAnimationFrame ||\n window.webkitRequestAnimationFrame ||\n window.mozRequestAnimationFrame ||\n window.oRequestAnimationFrame ||\n window.msRequestAnimationFrame ||\n requestAnimationFrame;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport dom from './dom/dom';\nimport common from
'./utils/common';\n\nclass CenteredDiv {\n constructor() {\n this.backgroundElement =
document.createElement('div');\n common.extend(this.backgroundElement.style,
{\n backgroundColor: 'rgba(0,0,0,0.8)',\n top: 0,\n left: 0,\n display: 'none',\n zIndex: '1000',\n
opacity: 0,\n WebkitTransition: 'opacity 0.2s linear',\n transition: 'opacity 0.2s linear'\n });\n\n
dom.makeFullscreen(this.backgroundElement);\n this.backgroundElement.style.position = 'fixed';\n\n
this.domElement = document.createElement('div');\n common.extend(this.domElement.style, {\n position:
'fixed',\n display: 'none',\n zIndex: '1001',\n opacity: 0,\n WebkitTransition: '-webkit-transform 0.2s
ease-out, opacity 0.2s linear',\n transition: 'transform 0.2s ease-out, opacity 0.2s linear'\n });\n\n\n
document.body.appendChild(this.backgroundElement);\n document.body.appendChild(this.domElement);\n\n
const _this = this;\n dom.bind(this.backgroundElement, 'click', function() {\n _this.hide();\n });\n }\n\n
show() {\n const _this = this;\n\n this.backgroundElement.style.display
= 'block';\n\n this.domElement.style.display = 'block';\n this.domElement.style.opacity = 0;\n//
this.domElement.style.top = '52%';\n this.domElement.style.webkitTransform = 'scale(1.1)';\n\n this.layout();\n\n
common.defer(function() {\n _this.backgroundElement.style.opacity = 1;\n _this.domElement.style.opacity =
1;\n _this.domElement.style.webkitTransform = 'scale(1)';\n });\n }\n\n /**\n * Hide centered div\n */\n
hide() {\n const _this = this;\n\n const hide = function() {\n _this.domElement.style.display = 'none';\n
_this.backgroundElement.style.display = 'none';\n\n dom.unbind(_this.domElement, 'webkitTransitionEnd',
hide);\n dom.unbind(_this.domElement, 'transitionend', hide);\n dom.unbind(_this.domElement,
'oTransitionEnd', hide);\n });\n\n dom.bind(this.domElement, 'webkitTransitionEnd', hide);\n
dom.bind(this.domElement, 'transitionend', hide);\n dom.bind(this.domElement, 'oTransitionEnd',
hide);\n\n this.backgroundElement.style.opacity = 0;\n// this.domElement.style.top = '48%';\n
this.domElement.style.opacity = 0;\n this.domElement.style.webkitTransform = 'scale(1.1)';\n }\n\n layout() {\n
this.domElement.style.left = window.innerWidth / 2 - dom.getWidth(this.domElement) / 2 + 'px';\n
this.domElement.style.top = window.innerHeight / 2 - dom.getHeight(this.domElement) / 2 + 'px';\n }\n}\n\nexport
default CenteredDiv;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *
Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed under the Apache License, Version 2.0 (the

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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\nimport css from './utils/css';\nimport
saveDialogueContents from './saveDialogue.html';\nimport ControllerFactory from
'./controllers/ControllerFactory';\nimport
Controller from './controllers/Controller';\nimport BooleanController from
'./controllers/BooleanController';\nimport FunctionController from './controllers/FunctionController';\nimport
NumberControllerBox from './controllers/NumberControllerBox';\nimport NumberControllerSlider from
'./controllers/NumberControllerSlider';\nimport ColorController from './controllers/ColorController';\nimport
requestAnimationFrame from './utils/requestAnimationFrame';\nimport CenteredDiv from
'./dom/CenteredDiv';\nimport dom from './dom/dom';\nimport common from './utils/common';\n\nimport
styleSheet from './style.scss'; // CSS to embed in build\nncss.inject(styleSheet);\n\n/** @ignore Outer-most
className for GUIs *\nconst CSS_NAMESPACE = 'dg';\n\nconst HIDE_KEY_CODE = 72;\n\n/** @ignore The
only value shared between the JS and SCSS. Use caution. *\nconst CLOSE_BUTTON_HEIGHT = 20;\n\nconst
DEFAULT_DEFAULT_PRESET_NAME = 'Default';\n\nconst SUPPORTS_LOCAL_STORAGE =
(function() {\n try {\n return !!window.localStorage;\n } catch (e) {\n return false;\n }\n})();\n\nlet
SAVE_DIALOGUE;\n\n/** @ignore Have we yet to create an autoPlace GUI? *\nlet autoPlaceVirgin =
true;\n\n/** @ignore Fixed position div that auto place GUI's go inside *\nlet autoPlaceContainer;\n\n/** @ignore
Are we hiding the GUI's ? *\nlet hide = false;\n\n/** @private GUI's which should be hidden *\nconst
hideableGuis = [];\n\n/**\n * @class A lightweight controller library for JavaScript. It allows you to easily\n *
manipulate variables and fire functions on the fly.\n *\n * @typicalname gui\n *\n * @example\n * // Creating a
GUI with options.\n * var gui = new dat.GUI({name: 'My GUI'});\n *\n * @example\n * // Creating a GUI and a
subfolder.\n * var gui = new dat.GUI();\n * var folder1 = gui.addFolder('Flow Field');\n *\n * @param {Object}
[params]\n * @param {String} [params.name] The name of this GUI.\n * @param {Object} [params.load] JSON
object representing the
saved state of\n * this GUI.\n * @param {dat.gui.GUI} [params.parent] The GUI I'm nested in.\n * @param
{Boolean} [params.autoPlace=true]\n * @param {Boolean} [params.hideable=true] If true, GUI is shown/hidden by
<kbd>h</kbd> keypress.\n * @param {Boolean} [params.closed=false] If true, starts closed\n * @param {Boolean}
[params.closeOnTop=false] If true, close/open button shows on top of the GUI\n *\nconst GUI = function(pars) {\n
const _this = this;\n\n let params = pars || {};\n\n /**\n * Outermost DOM Element\n * @type {DOMELEMENT}\n
*\n * ^\n this.domElement = document.createElement('div');\n this.__ul = document.createElement('ul');\n
this.domElement.appendChild(this.__ul);\n\n dom.addClass(this.domElement, CSS_NAMESPACE);\n\n /**\n *
Nested GUI's by name\n * @ignore\n * ^\n this.__folders = {};\n\n this.__controllers = [];\n\n /**\n * List of
objects I'm remembering for save, only used in top level GUI\n * @ignore\n * ^\n this.__rememberedObjects =
[];\n\n
/**\n * Maps the index of remembered objects to a map of controllers, only used\n * in top level GUI.\n *\n *
@private\n * @ignore\n *\n * @example\n * [\n * {\n * propertyName: Controller,\n *
anotherPropertyName: Controller\n * },\n * {\n * propertyName: Controller\n * }\n *]\n *\n\n this.__rememberedObjectIndecesToControllers = [];\n\n this.__listening = [];\n\n // Default parameters\n params =
common.defaults(params, {\n closeOnTop: false,\n autoPlace: true,\n width: GUI.DEFAULT_WIDTH\n
});\n\n params = common.defaults(params, {\n resizable: params.autoPlace,\n hideable: params.autoPlace\n
});\n\n if (!common.isUndefined(params.load)) {\n // Explicit preset\n if (params.preset) {\n
params.load.preset = params.preset;\n }\n } else {\n params.load = { preset:
DEFAULT_DEFAULT_PRESET_NAME }; }\n\n if (common.isUndefined(params.parent) &&
params.hideable) {\n hideableGuis.push(this);\n
}\n\n // Only root level GUI's are resizable.\n params.resizable = common.isUndefined(params.parent) &&
params.resizable;\n\n if (params.autoPlace && common.isUndefined(params.scrollable)) {\n params.scrollable =
true;\n }\n\n // params.scrollable = common.isUndefined(params.parent) && params.scrollable === true;\n\n // Not
part of params because I don't want people passing this in via\n // constructor. Should be a 'remembered' value.\n

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let useLocalStorage =\n SUPPORTS_LOCAL_STORAGE &&\n
localStorage.getItem(getLocalStorageHash(this, 'isLocal')) === 'true';\n\n let saveToLocalStorage;\n let
titleRow;\n\n Object.defineProperties(this,\n /** @lends GUI.prototype */\n {\n /**\n * The parent
<code>GUI</code>\n * @type dat.gui.GUI\n */\n parent: {\n get: function() {\n return
params.parent;\n }\n },\n scrollable: {\n get: function() {\n return params.scrollable;\n }\n }
,\n /**\n * Handles <code>GUI</code>'s element placement for you\n * @type Boolean\n */\n autoPlace: {\n get: function() {\n return params.autoPlace;\n }\n },\n /**\n * Handles
<code>GUI</code>'s position of open/close button\n * @type Boolean\n */\n closeOnTop: {\n get:
function() {\n return params.closeOnTop;\n }\n },\n /**\n * The identifier for a set of saved
values\n * @type String\n */\n preset: {\n get: function() {\n if (_this.parent) {\n return
_this.getRoot().preset;\n }\n return params.load.preset;\n },\n set: function(v) {\n if
(_this.parent) {\n _this.getRoot().preset = v;\n } else {\n params.load.preset = v;\n }\n }
,\n setPresetSelectIndex(this);\n _this.revert();\n }\n },\n /**\n * The width of <code>GUI</code> element\n * @type Number\n */\n width: {\n get: function() {\n return
params.width;\n },\n set: function(v) {\n params.width = v;\n setWidth(_this, v);\n }\n },\n /**\n * The name of <code>GUI</code>. Used for folders. i.e\n * a folder's name\n *
@type String\n */\n name: {\n get: function() {\n return params.name;\n },\n set:
function(v) {\n // TODO Check for collisions among sibling folders\n params.name = v;\n if
(titleRow) {\n titleRow.innerHTML = params.name;\n }\n },\n /**\n * Whether the
<code>GUI</code> is collapsed or not\n * @type Boolean\n */\n closed: {\n get: function() {\n return
params.closed;\n },\n set: function(v) {\n params.closed = v;\n if (params.closed)
{\n dom.addClass(_this.__ul, GUI.CLASS_CLOSED);\n } else {\n dom.removeClass(_this.__ul, GUI.CLASS_CLOSED);\n }\n }\n },\n // For browsers that aren't going to respect
the CSS transition,\n // Lets just check our height against the window height right off\n // the bat.\n this.onResize();\n if (_this.__closeButton) {\n _this.__closeButton.innerHTML = v ?
GUI.TEXT_OPEN : GUI.TEXT_CLOSED;\n }\n },\n /**\n * Contains all presets\n *
@type Object\n */\n load: {\n get: function() {\n return params.load;\n }\n },\n /**\n * Determines whether or not to use localStorage as the means for\n *
<code>remember</code>ing\n * @type Boolean\n */\n useLocalStorage: {\n get: function() {\n return useLocalStorage;\n },\n set: function(bool) {\n if (SUPPORTS_LOCAL_STORAGE) {\n useLocalStorage =
bool;\n }\n if (bool) {\n dom.bind(window, 'unload', saveToLocalStorage);\n } else {\n dom.unbind(window, 'unload', saveToLocalStorage);\n }\n }\n },\n localStorage.setItem(getLocalStorageHash(_this, 'isLocal'), bool);\n }\n }\n }\n });\n\n // Are we a
root level GUI?\n if (common.isUndefined(params.parent)) {\n this.closed = params.closed || false;\n dom.addClass(this.domElement, GUI.CLASS_MAIN);\n dom.makeSelectable(this.domElement, false);\n\n //
Are we supposed to be loading locally?\n if (SUPPORTS_LOCAL_STORAGE) {\n if (useLocalStorage) {\n _this.useLocalStorage = true;\n const savedGui = localStorage.getItem(getLocalStorageHash(this, 'gui'));\n if (savedGui) {\n params.load = JSON.parse(savedGui);\n }\n }\n this.__closeButton = document.createElement('div');\n this.__closeButton.innerHTML =
GUI.TEXT_CLOSED;\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BUTTON);\n if
(params.closeOnTop) {\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_TOP);\n }\n this.domElement.insertBefore(this.__closeButton, this.domElement.childNodes[0]);\n } else {\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BOTTOM);\n }\n this.domElement.appendChild(this.__closeButton);\n }\n\n dom.bind(this.__closeButton, 'click', function() {\n _this.closed = !_this.closed;\n });\n // Oh, you're a nested GUI!\n } else {\n if (params.closed === undefined)

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{\n params.closed = true;\n }\n\n const titleRowName = document.createTextNode(params.name);\n dom.addClass(titleRowName, 'controller-name');\n\n titleRow = addRow(_this, titleRowName);\n\n const\n onClickTitle = function(e) {\n e.preventDefault();\n _this.closed = !_this.closed;\n return\n false;\n };\n\n dom.addClass(this.__ul, GUI.CLASS_CLOSED);\n\n dom.addClass(titleRow, 'title');\n dom.bind(titleRow, 'click', onClickTitle);\n\n if (!params.closed) {\n this.closed = false;\n }\n}\n\nif\n(params.autoPlace) {\n if (common.isUndefined(params.parent)) {\n if (autoPlaceVirgin) {\n autoPlaceContainer = document.createElement('div');\n dom.addClass(autoPlaceContainer,\n CSS_NAMESPACE);\n dom.addClass(autoPlaceContainer, GUI.CLASS_AUTO_PLACE_CONTAINER);\n document.body.appendChild(autoPlaceContainer);\n autoPlaceVirgin = false;\n }\n\n // Put it in the dom\n for you.\n autoPlaceContainer.appendChild(this.domElement);\n\n // Apply the auto styles\n dom.addClass(this.domElement, GUI.CLASS_AUTO_PLACE);\n }\n\n\n // Make it not elastic.\n if\n (!this.parent) {\n setWidth(_this, params.width);\n }\n}\n\nthis.__resizeHandler = function() {\n _this.onResizeDebounce();\n\n };\n\n dom.bind(window, 'resize', this.__resizeHandler);\n dom.bind(this.__ul, 'webkitTransitionEnd',\n this.__resizeHandler);\n dom.bind(this.__ul, 'transitionend', this.__resizeHandler);\n dom.bind(this.__ul,\n 'oTransitionEnd', this.__resizeHandler);\n this.onResize();\n\n if (params.resizable) {\n addResizeHandle(this);\n }\n\n\n saveToLocalStorage = function() {\n if (SUPPORTS_LOCAL_STORAGE &&\n localStorage.getItem(getLocalStorageHash(_this, 'isLocal')) === 'true') {\n localStorage.setItem(getLocalStorageHash(_this, 'gui'), JSON.stringify(_this.getSaveObject()));\n }\n };\n\n //\n expose this method publicly\n this.saveToLocalStorageIfPossible = saveToLocalStorage;\n\n function resetWidth()\n {\n const root = _this.getRoot();\n root.width += 1;\n common.defer(function() {\n root.width -= 1;\n });\n }\n\n if (!params.parent) {\n resetWidth();\n }\n}\n\nGUI.toggleHide = function() {\n hide = !hide;\n common.each(hideableGuis, function(gui)\n {\n gui.domElement.style.display = hide ? 'none' : '';\n });\n}\n\nGUI.CLASS_AUTO_PLACE =\n'a';\nGUI.CLASS_AUTO_PLACE_CONTAINER = 'ac';\nGUI.CLASS_MAIN =\n'main';\nGUI.CLASS_CONTROLLER_ROW = 'cr';\nGUI.CLASS_TOO_TALL = 'taller-than-\nwindow';\nGUI.CLASS_CLOSED = 'closed';\nGUI.CLASS_CLOSE_BUTTON = 'close-\nbutton';\nGUI.CLASS_CLOSE_TOP = 'close-top';\nGUI.CLASS_CLOSE_BOTTOM = 'close-\nbottom';\nGUI.CLASS_DRAG = 'drag';\n\nGUI.DEFAULT_WIDTH = 245;\nGUI.TEXT_CLOSED = 'Close\nControls';\nGUI.TEXT_OPEN = 'Open Controls';\n\nGUI._keydownHandler = function(e) {\n if\n (document.activeElement.type !== 'text' &&\n (e.which === HIDE_KEY_CODE || e.keyCode ===\n HIDE_KEY_CODE)) {\n GUI.toggleHide();\n }\n};\n\n dom.bind(window, 'keydown', GUI._keydownHandler,\n false);\n\n common.extend(\n GUI.prototype,\n /** @lends GUI.prototype */\n {\n\n /**\n * Adds a new\n * {@link Controller} to the GUI. The type of controller created\n * is inferred from the initial value of\n * <code>object[property]</code>.\n *\n * For\n * color properties, see {@link addColor}.\n *\n * @param {Object} object The object to be\n * manipulated\n * @param {String} property The name of the property to be manipulated\n * @param\n * {Number} [min] Minimum allowed value\n * @param {Number} [max] Maximum allowed value\n * @param\n * {Number} [step] Increment by which to change value\n * @returns {Controller} The controller that was added to\n * the GUI.\n * @instance\n *\n * @example\n * // Add a string controller.\n * var person = {name:\n * 'Sam'};\n * gui.add(person, 'name');\n *\n * @example\n * // Add a number controller slider.\n * var\n * person = {age: 45};\n * gui.add(person, 'age', 0, 100);\n *\n * //\n * add: function(object, property) {\n * return\n * add(\n * this,\n * object,\n * property,\n * {\n * factoryArgs: Array.prototype.slice.call(arguments, 2)\n * }\n *);\n * },\n *\n * /**\n * * Adds a new color controller\n * to the GUI.\n * *\n * @param object\n * @param property\n * @returns {Controller} The controller that\n * was added to the GUI.\n * *\n * @instance\n *\n * @example\n * var palette = {\n * color1: '#FF0000', //\n * CSS string\n * color2: [0, 128, 255], // RGB array\n * color3: [0, 128, 255, 0.3], // RGB with alpha\n * color4: { h: 350, s: 0.9, v: 0.3 } // Hue, saturation, value\n * };\n * gui.addColor(palette, 'color1');\n *

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gui.addColor(palette, 'color2');\n * gui.addColor(palette, 'color3');\n * gui.addColor(palette, 'color4');\n *^\n
addColor: function(object, property) {\n return add(\n this,\n object,\n property,\n {\n
color: true\n } \n);\n },\n\n /**\n * Removes the given controller from the GUI.\n * @param
{Controller} controller\n * @instance\n *^\n remove: function(controller) {\n // TODO listening?\n
this.__ul.removeChild(controller.__li);\n
this.__controllers.splice(this.__controllers.indexOf(controller), 1);\n const _this = this;\n
common.defer(function() {\n _this.onResize();\n });\n },\n\n /**\n * Removes the root GUI from the
document and unbinds all event listeners.\n * For subfolders, use `gui.removeFolder(folder)` instead.\n *
@instance\n *^\n destroy: function() {\n if (this.parent) {\n throw new Error(\n 'Only the root GUI
should be removed with .destroy(). ' +\n 'For subfolders, use gui.removeFolder(folder) instead.\n);\n
}\n\n if (this.autoPlace) {\n autoPlaceContainer.removeChild(this.domElement);\n }\n\n const _this =
this;\n common.each(this.__folders, function(subfolder) {\n _this.removeFolder(subfolder);\n });\n\n
dom.unbind(window, 'keydown', GUI._keydownHandler, false);\n\n removeListeners(this);\n },\n\n /**\n *
Creates
a new subfolder GUI instance.\n * @param name\n * @returns {dat.gui.GUI} The new folder.\n * @throws
{Error} if this GUI already has a folder by the specified\n * name\n * @instance\n *^\n addFolder:
function(name) {\n // We have to prevent collisions on names in order to have a key\n // by which to
remember saved values\n if (this.__folders[name] !== undefined) {\n throw new Error('You already have a
folder in this GUI by the ' +\n ' name \'' + name + '\");\n }\n\n const newGuiParams = { name: name,
parent: this };\n\n // We need to pass down the autoPlace trait so that we can\n // attach event listeners to
open/close folder actions to\n // ensure that a scrollbar appears if the window is too short.\n
newGuiParams.autoPlace = this.autoPlace;\n\n // Do we have saved appearance data for this folder?\n if
(this.load && // Anything loaded?\n this.load.folders && // Was my parent a dead-end?\n
this.load.folders[name]) { // Did daddy remember me?\n // Start me closed if I was closed\n
newGuiParams.closed = this.load.folders[name].closed;\n\n // Pass down the loaded data\n
newGuiParams.load = this.load.folders[name];\n }\n\n const gui = new GUI(newGuiParams);\n
this.__folders[name] = gui;\n const li = addRow(this, gui.domElement);\n dom.addClass(li, 'folder');\n
return gui;\n },\n\n /**\n * Removes a subfolder GUI instance.\n * @param {dat.gui.GUI} folder The
folder to remove.\n * @instance\n *^\n removeFolder: function(folder) {\n
this.__ul.removeChild(folder.domElement.parentElement);\n\n delete this.__folders[folder.name];\n\n // Do
we have saved appearance data for this folder?\n if (this.load && // Anything loaded?\n this.load.folders &&
// Was my parent a dead-end?\n this.load.folders[folder.name]) {\n delete this.load.folders[folder.name];\n
}\n\n removeListeners(folder);\n\n const _this = this;\n\n common.each(folder.__folders,
function(subfolder) {\n folder.removeFolder(subfolder);\n });\n\n common.defer(function() {\n
_this.onResize();\n });\n },\n\n /**\n * Opens the GUI.\n *^\n open: function() {\n this.closed =
false;\n },\n\n /**\n * Closes the GUI.\n *^\n close: function() {\n this.closed = true;\n },\n\n /**\n
* Hides the GUI.\n *^\n hide: function() {\n this.domElement.style.display = 'none';\n },\n\n /**\n
* Shows the GUI.\n *^\n show: function() {\n this.domElement.style.display = '';\n },\n\n\n onResize:
function() {\n // we debounce this function to prevent performance issues when rotating on tablet/mobile\n
const root = this.getRoot();\n if (root.scrollable) {\n const top = dom.getOffset(root.__ul).top;\n let h =
0;\n\n common.each(root.__ul.childNodes,
function(node) {\n if (!(root.autoPlace && node === root.__save_row)) {\n h +=
dom.getHeight(node);\n }\n });\n\n if (window.innerHeight - top - CLOSE_BUTTON_HEIGHT < h)
{\n dom.addClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height =
window.innerHeight - top - CLOSE_BUTTON_HEIGHT + 'px';\n } else {\n
dom.removeClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height = 'auto';\n }\n
}\n\n if (root.__resize_handle) {\n common.defer(function() {\n root.__resize_handle.style.height =
root.__ul.offsetHeight + 'px';\n });\n }\n\n if (root.__closeButton) {\n root.__closeButton.style.width

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= root.width + 'px';\n }\n },\n onResizeDebounce: common.debounce(function() { this.onResize(); },
50),\n /**\n * Mark objects for saving. The order of these objects cannot change as\n
 * the GUI grows. When remembering new objects, append them to the end\n
 * of the list.\n
 * @param
 {...Object} objects\n
 * @throws {Error} if not called on a top level GUI.\n
 * @instance\n
 * @ignore\n
 */\n
remember: function() {\n if (common.isUndefined(SAVE_DIALOGUE)) {\n SAVE_DIALOGUE =
new CenteredDiv();\n SAVE_DIALOGUE.domElement.innerHTML = saveDialogueContents;\n }\n if
(this.parent) {\n throw new Error('You can only call remember on a top level GUI.);\n }\n const _this =
this;\n common.each(Array.prototype.slice.call(arguments), function(object) {\n if
(_this.__rememberedObjects.length === 0) {\n addSaveMenu(_this);\n }\n if
(_this.__rememberedObjects.indexOf(object) === -1) {\n _this.__rememberedObjects.push(object);\n }\n });\n if (this.autoPlace) {\n // Set save row width\n setWidth(this, this.width);\n }\n },\n /**\n * @returns {dat.gui.GUI} the topmost parent GUI of a nested GUI.\n
 * @instance\n
 */\n
getRoot: function() {\n let gui = this;\n while (gui.parent) {\n gui = gui.parent;\n }\n return gui;\n
},\n /**\n * @returns {Object} a JSON object representing the current state of\n
 * this GUI as well as its
remembered properties.\n
 * @instance\n
 */\n
getSaveObject: function() {\n const toReturn = this.load;\n toReturn.closed = this.closed;\n // Am I remembering any values?\n if (this.__rememberedObjects.length >
0) {\n toReturn.preset = this.preset;\n if (!toReturn.remembered) {\n toReturn.remembered = {};\n }\n toReturn.remembered[this.preset] = getCurrentPreset(this);\n }\n toReturn.folders = {};\n common.each(this.__folders, function(element, key) {\n toReturn.folders[key] = element.getSaveObject();\n });\n return
toReturn;\n },\n save: function() {\n if (!this.load.remembered) {\n this.load.remembered = {};\n }\n this.load.remembered[this.preset] = getCurrentPreset(this);\n markPresetModified(this, false);\n this.saveToLocalStorageIfPossible();\n },\n saveAs: function(presetName) {\n if (!this.load.remembered)
{\n // Retain default values upon first save\n this.load.remembered = {};\n this.load.remembered[DEFAULT_DEFAULT_PRESET_NAME] = getCurrentPreset(this, true);\n }\n this.load.remembered[presetName] = getCurrentPreset(this);\n this.preset = presetName;\n addPresetOption(this, presetName, true);\n this.saveToLocalStorageIfPossible();\n },\n revert: function(gui)
{\n common.each(this.__controllers, function(controller) {\n // Make revert work on Default.\n if
(!this.getRoot().load.remembered) {\n controller.setValue(controller.initialValue);\n } else {\n recallSavedValue(gui || this.getRoot(), controller);\n }\n // fire onFinishChange
callback\n if (controller.__onFinishChange) {\n controller.__onFinishChange.call(controller,
controller.getValue());\n }\n }, this);\n common.each(this.__folders, function(folder) {\n folder.revert(folder);\n });\n if (!gui) {\n markPresetModified(this.getRoot(), false);\n }\n },\n listen: function(controller) {\n const init = this.__listening.length === 0;\n this.__listening.push(controller);\n if (init) {\n updateDisplays(this.__listening);\n }\n },\n updateDisplay: function() {\n common.each(this.__controllers, function(controller) {\n controller.updateDisplay();\n });\n common.each(this.__folders, function(folder) {\n folder.updateDisplay();\n });\n }\n });\n /**\n * Add
a row to the end of the GUI or before another row.\n
 *\n
 * @param gui\n
 * @param [newDom] If specified, inserts the dom content in the new row\n
 * @param
[liBefore] If specified, places the new row before another row\n
 * @ignore\n
 */\n
function addRow(gui,
newDom, liBefore) {\n const li = document.createElement('li');\n if (newDom) {\n li.appendChild(newDom);\n }\n if (liBefore) {\n gui.__ul.insertBefore(li, liBefore);\n } else {\n gui.__ul.appendChild(li);\n }\n gui.onResize();\n return li;\n }\n }\n function removeListeners(gui) {\n dom.unbind(window, 'resize',
gui.__resizeHandler);\n if (gui.saveToLocalStorageIfPossible) {\n dom.unbind(window, 'unload',
gui.saveToLocalStorageIfPossible);\n }\n }\n function markPresetModified(gui, modified) {\n const opt =
gui.__preset_select[gui.__preset_select.selectedIndex];\n if (modified) {\n opt.innerHTML = opt.value + '*';\n } else {\n opt.innerHTML = opt.value;\n }\n }\n function augmentController(gui, li, controller) {\n controller.__li = li;\n controller.__gui

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= gui;\n\n common.extend(controller, /** @lends Controller.prototype */ {\n /**\n * @param {Array|Object}
options\n * @return {Controller}\n */\n options: function(options) {\n if (arguments.length > 1) {\n
const nextSibling = controller.__li.nextElementSibling;\n controller.remove();\n\n return add(\n gui,\n
controller.object,\n controller.property,\n {\n before: nextSibling,\n factoryArgs:
[common.toArray(arguments)]\n });\n }\n\n if (common.isArray(options) ||
common.isObject(options)) {\n const nextSibling = controller.__li.nextElementSibling;\n
controller.remove();\n\n return add(\n gui,\n controller.object,\n controller.property,\n {\n
before: nextSibling,\n factoryArgs: [options]\n });\n }\n },\n\n /**\n * Sets the
name of the
controller.\n * @param {string} name\n * @return {Controller}\n */\n name: function(name) {\n
controller.__li.firstChild.firstChild.innerHTML = name;\n return controller;\n },\n\n /**\n
* Sets controller to listen for changes on its underlying object.\n * @return {Controller}\n */\n listen:
function() {\n controller.__gui.listen(controller);\n return controller;\n },\n\n /**\n
* Removes the
controller from its parent GUI.\n * @return {Controller}\n */\n remove: function() {\n
controller.__gui.remove(controller);\n return controller;\n }\n });\n\n // All sliders should be accompanied by a
box.\n if (controller instanceof NumberControllerSlider) {\n const box = new
NumberControllerBox(controller.object, controller.property,\n { min: controller.__min, max: controller.__max,
step: controller.__step });\n\n common.each(['updateDisplay', 'onChange', 'onFinishChange', 'step',
'min', 'max'], function(method) {\n const pc = controller[method];\n const pb = box[method];\n
controller[method] = box[method] = function() {\n const args = Array.prototype.slice.call(arguments);\n
pb.apply(box, args);\n return pc.apply(controller, args);\n });\n\n dom.addClass(li, 'has-slider');\n
controller.domElement.insertBefore(box.domElement, controller.domElement.firstChild);\n } else if
(controller instanceof NumberControllerBox) {\n const r = function(returned) {\n // Have we defined both
boundaries?\n if (common.isNumber(controller.__min) && common.isNumber(controller.__max)) {\n //
Well, then lets just replace this with a slider.\n\n // lets remember if the old controller had a specific name or
was listening\n const oldName = controller.__li.firstChild.firstChild.innerHTML;\n const
wasListening = controller.__gui.__listening.indexOf(controller) > -1;\n\n
controller.remove();\n const newController = add(\n gui,\n controller.object,\n
controller.property,\n {\n before: controller.__li.nextElementSibling,\n factoryArgs:
[controller.__min, controller.__max, controller.__step]\n });\n\n newController.name(oldName);\n if
(wasListening) newController.listen();\n\n return newController;\n }\n\n return returned;\n });\n\n
controller.min = common.compose(r, controller.min);\n controller.max = common.compose(r, controller.max);\n
} else if (controller instanceof BooleanController) {\n dom.bind(li, 'click', function() {\n
dom.fakeEvent(controller.__checkbox, 'click');\n });\n\n dom.bind(controller.__checkbox, 'click', function(e) {\n
e.stopPropagation(); // Prevents double-toggle\n });\n } else if (controller instanceof FunctionController) {\n
dom.bind(li, 'click', function() {\n dom.fakeEvent(controller.__button,
'click');\n });\n\n dom.bind(li, 'mouseover', function() {\n dom.addClass(controller.__button, 'hover');\n
});\n\n dom.bind(li, 'mouseout', function() {\n dom.removeClass(controller.__button, 'hover');\n });\n } else
if (controller instanceof ColorController) {\n dom.addClass(li, 'color');\n controller.updateDisplay =
common.compose(function(val) {\n li.style.borderLeftColor = controller.__color.toString();\n return val;\n
}, controller.updateDisplay);\n\n controller.updateDisplay();\n }\n\n controller.setValue =
common.compose(function(val) {\n if (gui.getRoot().__preset_select && controller.isModified()) {\n
markPresetModified(gui.getRoot(), true);\n }\n\n return val;\n }, controller.setValue);\n\n\nfunction
recallSavedValue(gui, controller) {\n // Find the topmost GUI, that's where remembered objects live.\n const root =
gui.getRoot();\n\n // Does the object we're controlling match anything we've
been told to\n // remember?\n const matchedIndex = root.__rememberedObjects.indexOf(controller.object);\n\n //
Why yes, it does!\n if (matchedIndex !== -1) {\n // Let me fetch a map of controllers for th\ncommon.isObject.\n
let controllerMap = root.__rememberedObjectIndecesToControllers[matchedIndex];\n\n // Ohp, I believe this is

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the first controller we've created for this\n // object. Lets make the map fresh.\n if (controllerMap ===
undefined) {\n controllerMap = {};\n root.__rememberedObjectIndecesToControllers[matchedIndex] =\n controllerMap;\n }\n\n // Keep track of this controller\n controllerMap[controller.property] = controller;\n\n // Okay, now have we saved any values for this controller?\n if (root.load && root.load.remembered) {\n const
presetMap = root.load.remembered;\n\n // Which preset are we trying to load?\n let preset;\n\n if
(presetMap[gui.preset]) {\n preset = presetMap[gui.preset];\n
} else if (presetMap[DEFAULT_DEFAULT_PRESET_NAME]) {\n // Uhh, you can have the default
instead?\n preset = presetMap[DEFAULT_DEFAULT_PRESET_NAME];\n } else {\n // Nada.\n
return;\n }\n\n // Did the loaded object remember thcommon.isObject? && Did we remember this particular
property?\n if (preset[matchedIndex] && preset[matchedIndex][controller.property] !== undefined) {\n //
We did remember something for this guy ...\n const value = preset[matchedIndex][controller.property];\n\n
// And that's what it is.\n controller.initialValue = value;\n controller.setValue(value);\n }\n }\n\n
}\n\nfunction add(gui, object, property, params) {\n if (object[property] === undefined) {\n throw new
Error(`Object "${object}" has no property "${property}"`);\n }\n\n let controller;\n\n if (params.color) {\n
controller = new ColorController(object, property);\n } else {\n const factoryArgs = [object,
property].concat(params.factoryArgs);\n controller = ControllerFactory.apply(gui, factoryArgs);\n }\n\n if
(params.before instanceof Controller) {\n params.before = params.before.__li;\n }\n\n recallSavedValue(gui,
controller);\n\n dom.addClass(controller.domElement, 'c');\n\n const name = document.createElement('span');\n
dom.addClass(name, 'property-name');\n name.innerHTML = controller.property;\n\n const container =
document.createElement('div');\n container.appendChild(name);\n
container.appendChild(controller.domElement);\n\n const li = addRow(gui, container, params.before);\n\n
dom.addClass(li, GUI.CLASS_CONTROLLER_ROW);\n if (controller instanceof ColorController) {\n
dom.addClass(li, 'color');\n } else {\n dom.addClass(li, typeof controller.getValue());\n }\n\n
augmentController(gui, li, controller);\n\n gui.__controllers.push(controller);\n\n return controller;\n }\n\nfunction
getLocalStorageHash(gui, key) {\n // TODO how does this deal with
multiple GUI's?\n return document.location.href + '.' + key;\n }\n\nfunction addPresetOption(gui, name,
setSelected) {\n const opt = document.createElement('option');\n opt.innerHTML = name;\n opt.value = name;\n
gui.__preset_select.appendChild(opt);\n if (setSelected) {\n gui.__preset_select.selectedIndex =
gui.__preset_select.length - 1;\n }\n }\n\nfunction showHideExplain(gui, explain) {\n explain.style.display =
gui.useLocalStorage ? 'block' : 'none';\n }\n\nfunction addSaveMenu(gui) {\n const div = gui.__save_row =
document.createElement('li');\n\n dom.addClass(gui.domElement, 'has-save');\n\n gui.__ul.insertBefore(div,
gui.__ul.firstChild);\n\n dom.addClass(div, 'save-row');\n\n const gears = document.createElement('span');\n
gears.innerHTML = ' ';\n dom.addClass(gears, 'button gears');\n\n // TODO replace with
FunctionController\n const button = document.createElement('span');\n button.innerHTML = 'Save';\n
dom.addClass(button, 'button');\n dom.addClass(button,
'save');\n\n const button2 = document.createElement('span');\n button2.innerHTML = 'New';\n
dom.addClass(button2, 'button');\n dom.addClass(button2, 'save-as');\n\n const button3 =
document.createElement('span');\n button3.innerHTML = 'Revert';\n dom.addClass(button3, 'button');\n
dom.addClass(button3, 'revert');\n\n const select = gui.__preset_select = document.createElement('select');\n\n if
(gui.load && gui.load.remembered) {\n common.each(gui.load.remembered, function(value, key) {\n
addPresetOption(gui, key, key === gui.preset);\n });\n } else {\n addPresetOption(gui,
DEFAULT_DEFAULT_PRESET_NAME, false);\n }\n\n dom.bind(select, 'change', function() {\n for (let index
= 0; index < gui.__preset_select.length; index++) {\n gui.__preset_select[index].innerHTML =
gui.__preset_select[index].value;\n }\n\n gui.preset = this.value;\n });\n\n div.appendChild(select);\n
div.appendChild(gears);\n div.appendChild(button);\n div.appendChild(button2);\n
div.appendChild(button3);\n\n if (SUPPORTS_LOCAL_STORAGE) {\n const explain =
document.getElementById('dg-local-explain');\n const localStorageCheckBox = document.getElementById('dg-
local-storage');\n const saveLocally = document.getElementById('dg-save-locally');\n

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saveLocally.style.display = 'block';\n\n if (localStorage.getItem(getLocalStorageHash(gui, 'isLocal')) === 'true')
 {\n localStorageCheckBox.setAttribute('checked', 'checked');\n }\n\n showHideExplain(gui, explain);\n\n //
 TODO: Use a boolean controller, fool!\n dom.bind(localStorageCheckBox, 'change', function() {\n
 gui.useLocalStorage = !gui.useLocalStorage;\n showHideExplain(gui, explain);\n });\n\n const
 newConstructorTextArea = document.getElementById('dg-new-constructor');\n\n
 dom.bind(newConstructorTextArea, 'keydown', function(e) {\n if (e.metaKey && (e.which === 67 || e.keyCode
 === 67)) {\n SAVE_DIALOGUE.hide();\n }\n });\n\n dom.bind(gears,
 'click', function() {\n newConstructorTextArea.innerHTML = JSON.stringify(gui.getSaveObject(), undefined,
 2);\n SAVE_DIALOGUE.show();\n newConstructorTextArea.focus();\n newConstructorTextArea.select();\n
 });\n\n dom.bind(button, 'click', function() {\n gui.save();\n });\n\n dom.bind(button2, 'click', function() {\n
 const presetName = prompt('Enter a new preset name.);\n if (presetName) {\n gui.saveAs(presetName);\n }\n
 });\n\n dom.bind(button3, 'click', function() {\n gui.revert();\n });\n\n //
 div.appendChild(button2);\n\n\n function addResizeHandle(gui) {\n let pmouseX;\n\n gui.__resize_handle =
 document.createElement('div');\n\n common.extend(gui.__resize_handle.style, {\n\n width: '6px',\n marginLeft:
 '-3px',\n height: '200px',\n cursor: 'ew-resize',\n position: 'absolute'\n // border: '1px solid blue'\n\n });\n\n
 function drag(e) {\n e.preventDefault();\n\n gui.width += pmouseX - e.clientX;\n gui.onResize();\n
 pmouseX = e.clientX;\n\n return false;\n }\n\n function dragStop() {\n dom.removeClass(gui.__closeButton,
 GUI.CLASS_DRAG);\n dom.unbind(window, 'mousemove', drag);\n dom.unbind(window, 'mouseup',
 dragStop);\n }\n\n function dragStart(e) {\n e.preventDefault();\n\n pmouseX = e.clientX;\n\n
 dom.addClass(gui.__closeButton, GUI.CLASS_DRAG);\n dom.bind(window, 'mousemove', drag);\n
 dom.bind(window, 'mouseup', dragStop);\n\n return false;\n }\n\n dom.bind(gui.__resize_handle, 'mousedown',
 dragStart);\n dom.bind(gui.__closeButton, 'mousedown', dragStart);\n\n
 gui.domElement.insertBefore(gui.__resize_handle, gui.domElement.firstChild);\n\n\n function
 setWidth(gui, w) {\n gui.domElement.style.width = w + 'px';\n // Auto placed save-rows are position fixed, so we
 have to\n // set the width manually if we want it to bleed to the edge\n if (gui.__save_row && gui.autoPlace) {\n
 gui.__save_row.style.width = w + 'px';\n }\n if (gui.__closeButton)
 {\n gui.__closeButton.style.width = w + 'px';\n }\n\n\n function getCurrentPreset(gui, useInitialValues) {\n
 const toReturn = {};\n\n // For each object I'm remembering\n common.each(gui.__rememberedObjects,
 function(val, index) {\n const savedValues = {};\n\n // The controllers I've made for thcommon.isObject by
 property\n const controllerMap =\n gui.__rememberedObjectIndecesToControllers[index];\n\n // Remember
 each value for each property\n common.each(controllerMap, function(controller, property) {\n
 savedValues[property] = useInitialValues ? controller.initialValue : controller.getValue();\n });\n\n // Save the
 values for thcommon.isObject\n toReturn[index] = savedValues;\n });\n\n return toReturn;\n\n\n function
 setPresetSelectIndex(gui) {\n for (let index = 0; index < gui.__preset_select.length; index++) {\n if
 (gui.__preset_select[index].value === gui.preset) {\n gui.__preset_select.selectedIndex = index;\n
 }\n }\n\n\n function updateDisplays(controllerArray) {\n if (controllerArray.length !== 0) {\n
 requestAnimationFrame.call(window, function() {\n updateDisplays(controllerArray);\n });\n }\n\n\n
 common.each(controllerArray, function(c) {\n c.updateDisplay();\n });\n\n\n export default GUI;\n\n // stats.js -
 http://github.com/mrdoob/stats.js\n (function(f,e){"object"===typeof exports&&"undefined"!=="typeof
 module?module.exports=e):"function"===typeof define&&define.amd?define(e):f.Stats=e})(this,function(){var
 f=function(){function e(a){c.appendChild(a.dom);return a}function u(a){for(var
 d=0;d<c.children.length;d++)c.children[d].style.display=d===a?"block":"none";l=a}var
 l=0,c=document.createElement("div");c.style.cssText="position:fixed;top:0;left:0;cursor:pointer;opacity:0.9;z-
 index:10000";c.addEventListener("click",function(a){a.preventDefault();\nu(++l%c.children.length)},1);var
 k=(performance||Date).now(),g=k,a=0,r=e(new f.Panel("FPS","\n#0ff","\n#002")),h=e(new
 f.Panel("MS","\n#0f0","\n#020"));if(self.performance&&self.performance.memory)var t=e(new
 f.Panel("MB","\n#f08","\n#201"));u(0);return{REVISION:16,dom:c,addPanel:e,showPanel:u,begin:function(){k=(p
 erformance||Date).now(),end:function(){a++;var c=(performance||Date).now();h.update(c-

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k,200);if(c>g+1E3&&(r.update(1E3*a/(c-g),100),g=c,a=0,t)){ var
d=performance.memory;t.update(d.usedJSHeapSize/\n1048576,d.jsHeapSizeLimit/1048576)}return
c},update:function(){k=this.end(),domElement:c,setName:u}};f.Panel=function(e,f,l){ var
c=Infinity,k=0,g=Math.round,a=g(window.devicePixelRatio|1),r=80*a,h=48*a,t=3*a,v=2*a,d=3*a,m=15*a,n=74*a
,p=30*a,q=document.createElement("canvas");q.width=r;q.height=h;q.style.cssText="width:80px;height:48px";v
ar b=q.getContext("2d");b.font="bold "+9*a+"px Helvetica,Arial,sans-
serif";b.textBaseline="top";b.fillStyle=l;b.fillRect(0,0,r,h);b.fillStyle=f;b.fillText(e,t,v);\nb.fillRect(d,m,n,p);b.fill
Style=l;b.globalAlpha=.9;b.fillRect(d,m,n,p);return{ dom:q,update:function(h,w){c=Math.min(c,h);k=Math.max(k,h
);b.fillStyle=l;b.globalAlpha=1;b.fillRect(0,0,r,m);b.fillStyle=f;b.fillText(g(h)+"
"+e+" ("+"g(c)+"+"+"g(k)+"")",t,v);b.drawImage(q,d+a,m,n-a,p,d,m,n-a,p);b.fillRect(d+n-
a,m,a,p);b.fillStyle=l;b.globalAlpha=.9;b.fillRect(d+n-a,m,a,g((1-h/w)*p))}};return f}};\n",/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*/\nimport*as tf from"@tensorflow/tfjs-
core";import{util,tidy,div,sub,buffer,Tensor,browser,pad3d,scalar,concat,tensor2d,tensor}from"@tensorflow/tfjs-
core";import{loadGraphModel}from"@tensorflow/tfjs-converter";var
VALID_OUTPUT_STRIDES=[8,16,32];function assertValidOutputStride(e){util.assert("number"===typeof
e,function(){return"outputStride is not a
number"}),util.assert(VALID_OUTPUT_STRIDES.indexOf(e)>=0,function(){return"outputStride of "+e+" is
invalid. It must be either 8, 16, or 32"})}function assertValidResolution(e,t){util.assert("number"===typeof
e,function(){return"resolution is not a number"}),util.assert((e-1)%t===0,function(){return"resolution of "+e+" is
invalid for output stride "+t+"."})}function toFloatIfInt(e){return
tidy(function(){return"int32"===e.dtype&&(e=e.toFloat()),e=div(e,127.5),sub(e,1)})}var
MobileNet=function(){function e(e,t){this.model=e;var
r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-1===r[2],function(){return"Input shape ["+r[1]+"",
"+r[2]+""] must both be -1"}),this.outputStride=t}return e.prototype.predict=function(e){var t=this;return
tidy(function(){var
r=toFloatIfInt(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2],a=n[3];return{heatmapScores:i.squeeze(
).sigmoid(),offsets:o.squeeze(),displacementFwd:s.squeeze(),displacementBwd:a.squeeze()}}),e.prototype.dispose
=function(){this.model.dispose(),e()};function half(e){return Math.floor(e/2)}var MaxHeap=function(){function
e(e,t){this.priorityQueue=new Array(e),this.numberOfElements=-1,this.getElementValue=t}return
e.prototype.enqueue=function(e){this.priorityQueue[++this.numberOfElements]=e,this.swim(this.numberOfElemen
ts)},e.prototype.dequeue=function(){var e=this.priorityQueue[0];return this.exchange(0,this.numberOfElements--
),this.sink(0),this.priorityQueue[this.numberOfElements+1]=null,e},e.prototype.empty=function(){return-
1===this.numberOfElements},e.prototype.size=function(){return
this.numberOfElements+1},e.prototype.all=function(){return
this.priorityQueue.slice(0,this.numberOfElements+1)},e.prototype.max=function(){return
this.priorityQueue[0]},e.prototype.swim=function(e){for(;e>0&&this.less(half(e),e);)this.exchange(e,half(e)),e=half
(e)},e.prototype.sink=function(e){for(;2*e<=this.numberOfElements;){var
t=2*e;if(t<this.numberOfElements&&this.less(t,t+1)&&t++,!this.less(e,t))break;this.exchange(e,t),e=t}},e.prototype
.getValueAt=function(e){return this.getElementValue(this.priorityQueue[e])},e.prototype.less=function(e,t){return
this.getValueAt(e)<this.getValueAt(t)},e.prototype.exchange=function(e,t){var

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r=this.priorityQueue[e];this.priorityQueue[e]=this.priorityQueue[t],this.priorityQueue[t]=r,e})();function
scoreIsMaximumInLocalWindow(e,t,r,n,o,i){for(var s=i.shape,a=s[0],u=s[1],l=!0,f=Math.max(r-
o,0),c=Math.min(r+o+1,a),d=f;d<c;++d){for(var p=Math.max(n-
o,0),h=Math.min(n+o+1,u),m=p;m<h;++m)if(i.get(d,m,e)>t){l=!1;break}if(!l)break}return
l}function buildPartWithScoreQueue(e,t,r){for(var n=r.shape,o=n[0],i=n[1],s=n[2],a=new
MaxHeap(o*i*s,function(e){return e.score}),u=0;u<o;++u)for(var l=0;l<i;++l)for(var f=0;f<s;++f){var
c=r.get(u,l,f);c<e||scoreIsMaximumInLocalWindow(f,c,u,l,t,r)&&a.enqueue({score:c,part:{heatmapY:u,heatmapX:l,
id:f}})}return a}var
partNames=["nose","leftEye","rightEye","leftEar","rightEar","leftShoulder","rightShoulder","leftElbow",
"rightElbow","leftWrist","rightWrist","leftHip","rightHip","leftKnee","rightKnee","leftAnkle","rightAn
kle"],NUM_KEYPOINTS=partNames.length,partIds=partNames.reduce(function(e,t,r){return
e[t]=r,e,{}),connectedPartNames=[["leftHip","leftShoulder"],["leftElbow","leftShoulder"],["leftElbow","lef
tWrist"],["leftHip","leftKnee"],["leftKnee","leftAnkle"],["rightHip","rightShoulder"],["rightElbow","righ
tShoulder"],["rightElbow","rightWrist"],["rightHip","rightKnee"],["rightKnee","rightAnkle"],["leftShould
er","rightShoulder"],["leftHip","rightHip"]],poseChain=[["nose","leftEye"],["leftEye","leftEar"],["nose",
"rightEye"],["rightEye","rightEar"],["nose","leftShoulder"],["leftShoulder","leftElbow"],["leftElbow","l
eftWrist"],["leftShoulder","leftHip"],["leftHip","leftKnee"],["leftKnee","leftAnkle"],["nose","rightShould
er"],["rightShoulder","rightElbow"],["rightElbow","rightWrist"],["rightShoulder","rightHip"],["rightHip",
"rightKnee"],["rightKnee","rightAnkle"]],connectedPartIndices=connectedPartNames.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),partChannels=["left_face","right_face","right_upper_leg_front","rig
ht_lower_leg_back","right_upper_leg_back","left_lower_leg_front","left_upper_leg_front","left_upper_leg_ba
ck","left_lower_leg_back","right_feet","right_lower_leg_front","left_feet","torso_front","torso_back","rig
ht_upper_arm_front","right_upper_arm_back","right_lower_arm_back","left_lower_arm_front","left_upper_ar
m_front","left_upper_arm_back","left_lower_arm_back","right_hand","right_lower_arm_front","left_hand"];function
getOffsetPoint(e,t,r,n){return{y:n.get(e,t,r),x:n.get(e,t,r+NUM_KEYPOINTS)}}function getImageCoords(e,t,r){var
n=getOffsetPoint(e.heatmapY,e.heatmapX,e.id,r),o=n.y,i=n.x;return{x:e.heatmapX*t+i,y:e.heatmapY*t+o}}functio
n clamp(e,t,r){return e<t?t:e>r?r:e}function squaredDistance(e,t,r,n){var o=r-e,i=n-t;return o*o+i*i}function
addVectors(e,t){return{x:e.x+t.x,y:e.y+t.y}}var parentChildrenTuples=poseChain.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),parentToChildEdges=parentChildrenTuples.map(function(e){return
e[1]}),childToParentEdges=parentChildrenTuples.map(function(e){return e[0]});function
getDisplacement(e,t,r){var n=r.shape[2]/2;return{y:r.get(t.y,t.x,e),x:r.get(t.y,t.x,n+e)}}function
getStridedIndexNearPoint(e,t,r,n){return{y:clamp(Math.round(e.y/t),0,r-1),x:clamp(Math.round(e.x/t),0,n-
1)}}function
traverseToTargetKeypoint(e,t,r,n,o,i,s,a){void 0===a&&(a=2);for(var
u=n.shape,l=u[0],f=u[1],c=getDisplacement(e,getStridedIndexNearPoint(t.position,i,l,f),s),d=addVectors(t.position,c
),p=0;p<a;p++){var
h=getStridedIndexNearPoint(d,i,l,f),m=getOffsetPoint(h,y,h.x,r,o);d=addVectors({x:h.x*i,y:h.y*i},{x:m.x,y:m.y})}
var g=getStridedIndexNearPoint(d,i,l,f),_=n.get(g,y,g.x,r);return{position:d,part:partNames[r],score:_}}function
decodePose(e,t,r,n,o,i){var s=t.shape[2],a=parentToChildEdges.length,u=new
Array(s),l=e.part,f=e.score,c=getImageCoords(l,n,r);u[l.id]={score:f,part:partNames[l.id],position:c};for(var d=a-
1;d>=0;--d){var
p=parentToChildEdges[d],h=childToParentEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTargetKeypoint(d,u[p],h,t,r,n
,i))for(d=0;d<a;++d){p=childToParentEdges[d],h=parentToChildEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTarge
tKeypoint(d,u[p],h,t,r,n,o))}return u}function withinNmsRadiusOfCorrespondingPoint(e,t,r,n){var o=r.x,i=r.y;return
e.some(function(e){var r=e.keypoints[n].position;return squaredDistance(i,o,r.y,r.x)<=t})}function
getInstanceScore(e,t,r){return r.reduce(function(r,n,o){var i=n.position,s=n.score;return
withinNmsRadiusOfCorrespondingPoint(e,t,i,o)||r+=s},r),0)/r.length}var kLocalMaximumRadius=1;function

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decodeMultiplePoses(e,t,r,n,o,i,s,a){void 0===s&&(s=.5),void 0===a&&(a=20);for(var
u=[],l=buildPartWithScoreQueue(s,kLocalMaximumRadius,e),f=a*a;u.length<i&&!l.empty();){var
c=l.dequeue();if(!withinNmsRadiusOfCorrespondingPoint(u,f.getImageCoords(c.part,o,t),c.part.id)){var
d=decodePose(c,e,t,o,r,n),p=getInstanceScore(u,f,d);u.push({keypoints:d,score:p})}}return u}var
__assign=function(){return(__assign=Object.assign||function(e){for(var t,r=1,n=arguments.length;r<n;r++)for(var o
in t=arguments[r])Object.prototype.hasOwnProperty.call(t,o)&&(e[o]=t[o]);return
e}).apply(this,arguments)};function __awaiter(e,t,r,n){return new(r||(r=Promise))(function(o,i){function
s(e){try{u(n.next(e))}catch(e){i(e)}}function
a(e){try{u(n.throw(e))}catch(e){i(e)}}function u(e){e.done?o(e.value):new
r(function(t){t(e.value)}).then(s,a)}u((n=n.apply(e,t||[])).next())}}function __generator(e,t){var
r,n,o,i,s={label:0,sent:function(){if(1&o[0])throw o[1];return o[1]},trys:[],ops:[]};return
i={next:a(0),throw:a(1),return:a(2)},"function"==typeof Symbol&&(i[Symbol.iterator]=function(){return
this}),i;function a(i){return function(a){return function(i){if(r)throw new TypeError("\Generator is already
executing.\");for(;s;try{if(r=1,n&&(o=2&i[0]?n.return:i[0]?n.throw||((o=n.return)&&o.call(n),0):n.next)&&!
(o=o.call(n,i[1])).done)return o;switch(n=0,o&&(i=[2&i[0],o.value]),i[0]){case 0:case 1:o=i;break;case 4:return
s.label++,{value:i[1],done:!1};case 5:s.label++,n=i[1],i=[0];continue;case
7:i=s.ops.pop(),s.trys.pop();continue;default:if(!(o=(o=s.trys).length>0&&o[o.length-
1])&&(6===i[0]||2===i[0])){s=0;continue}if(3===i[0]&&(o|i[1]>o[0]&&i[1]<o[3])){s.label=i[1];break}if(6===i[
0]&&s.label<o[1]){s.label=o[1],o=i;break}if(o&&s.label<o[2]){s.label=o[2],s.ops.push(i);break}o[2]&&s.ops.pop(
),s.trys.pop();continue}i=t.call(e,s)}catch(e){i=[6,e],n=0}finally{r=o=0}if(5&i[0])throw
i[1];return{value:i[0]?i[1]:void 0,done:!0}}([i,a])}}function eitherPointDoesntMeetConfidence(e,t,r){return
e<r||t<r}function getAdjacentKeyPoints(e,t){return connectedPartIndices.reduce(function(r,n){var
o=n[0],i=n[1];return eitherPointDoesntMeetConfidence(e[o].score,e[i].score,t)?r:(r.push([e[o],e[i]]),r),[])}var
NEGATIVE_INFINITY=Number.NEGATIVE_INFINITY,POSITIVE_INFINITY=Number.POSITIVE_INFINITY
;function getBoundingBox(e){return e.reduce(function(e,t){var
r=e.maxX,n=e.maxY,o=e.minX,i=e.minY,s=t.position,a=s.x,u=s.y;return {maxX:Math.max(r,a),maxY:Math.max(n,
u),minX:Math.min(o,a),minY:Math.min(i,u)}, {maxX:NEGATIVE_INFINITY,maxY:NEGATIVE_INFINITY,min
X:POSITIVE_INFINITY,minY:POSITIVE_INFINITY})}function getBoundingBoxPoints(e){var
t=getBoundingBox(e),r=t.minX,n=t.minY,o=t.maxX,i=t.maxY;return[{x:r,y:n},{x:o,y:n},{x:o,y:i},{x:r,y:i}]function
on
toTensorBuffer(e,t){return void 0===t&&(t="float32"),__awaiter(this,void 0,void 0,function(){var r;return
__generator(this,function(n){switch(n.label){case 0:return[4,e.data()];case 1:return
r=n.sent(),[2,buffer(e.shape,t,r)]}})}function toTensorBuffers3D(e){return __awaiter(this,void 0,void
0,function(){return __generator(this,function(t){return[2,Promise.all(e.map(function(e){return
toTensorBuffer(e,"float32")})])})}function scalePose(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),{score:e.score,keypoints:e.keypoints.map(function(e){var
i=e.score,s=e.part,a=e.position;return{score:i,part:s,position:{x:a.x*r+o,y:a.y*t+n}}}})}function
scalePoses(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),1===r&&1===t&&0===n&&0===o?e:e.map(function(e){return scalePose(e,t,r,n,o)})}function
flipPoseHorizontal(e,t){return {score:e.score,keypoints:e.keypoints.map(function(e){var
r=e.score,n=e.part,o=e.position;return{score:r,part:n,position:{x:t-1-o.x,y:o.y}}}})}function
flipPosesHorizontal(e,t){return t<=0?e:e.map(function(e){return flipPoseHorizontal(e,t)})}function
getInputTensorDimensions(e){return e instanceof Tensor?[e.shape[0],e.shape[1]]:[e.height,e.width]}function
toInputTensor(e){return e instanceof Tensor?e.browser.fromPixels(e)}function padAndResizeTo(e,t){var
r=t[0],n=t[1],o=getInputTensorDimensions(e),i=o[0],s=o[1],a=n/r,u=[0,0,0,0],l=u[0],f=u[1],c=u[2],d=u[3];return
s/i<a?(l=0,f=0,c=Math.round(.5*(a*i-s)),d=Math.round(.5*(a*i-s)):(l=Math.round(.5*(1/a*s-
i)),f=Math.round(.5*(1/a*s-i)),c=0,d=0),{resized:tidy(function(){var
t=toInputTensor(e);return(t=pad3d(t,[[l,f],[c,d],[0,0]])).resizeBilinear([r,n])}),padding:{top:l,left:c,right:d,bottom:f}

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}}function scaleAndFlipPoses(e,t,r,n,o){var
i=t[0],s=t[1],a=r[0],u=r[1],l=scalePoses(e,(i+n.top+n.bottom)/a,(s+n.left+n.right)/u,-n.top,-n.left);return
o?flipPosesHorizontal(l,s):l}function mod(e,t){return tidy(function(){var r=e.div(scalar(t,"int32"));return
e.sub(r.mul(scalar(t,"int32")))}function
argmax2d(e){var t=e.shape,r=t[0],n=t[1],o=t[2];return tidy(function(){var
t=e.reshape([r*n,o]).argMax(0),i=t.div(scalar(n,"int32")).expandDims(1),s=mod(t,n).expandDims(1);return
concat([i,s,1])})}function getPointsConfidence(e,t){for(var r=t.shape[0],n=new Float32Array(r),o=0;o<r;o++){var
i=t.get(o,0),s=t.get(o,1);n[o]=e.get(i,s,o)}return n}function
getOffsetPoint$1(e,t,r,n){return {y:n.get(e,t,r),x:n.get(e,t+r+NUM_KEYPOINTS)}}function
getOffsetVectors(e,t){for(var r=[],n=0;n<NUM_KEYPOINTS;n++){var
o=getOffsetPoint$1(e.get(n,0).valueOf(),e.get(n,1).valueOf(),n,t),i=o.x,s=o.y;r.push(s),r.push(i)}return
tensor2d(r,[NUM_KEYPOINTS,2])}function getOffsetPoints(e,t,r){return tidy(function(){var
n=getOffsetVectors(e,r);return e.toTensor().mul(scalar(t,"int32")).toFloat().add(n)}function
decodeSinglePose(e,t,r){return __awaiter(this,void 0,void 0,function(){var n,o,i,s,a,u,l,f,c,d;return
__generator(this,function(p){switch(p.label){case 0:return
n=0,o=argmax2d(e),[4,Promise.all([toTensorBuffer(e),toTensorBuffer(t),toTensorBuffer(o,"int32")]);case
1:return i=p.sent(),s=i[0],a=i[1],u=i[2],[4,toTensorBuffer(l=getOffsetPoints(u,r,a));case 2:return
f=p.sent(),c=Array.from(getPointsConfidence(s,u)),d=c.map(function(e,t){return
n+=e,{position:{y:f.get(t,0),x:f.get(t,1)},part:partNames[t],score:e}},o.dispose(),l.dispose()),[2,{keypoints:d,score:n
/d.length}]}))}var MOBILENET_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/mobilenet^",RESNET50_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/resnet50^";function resNet50Checkpoint(e,t){var r="model-stride"+e+"\json";return
4==t?RESNET50_BASE_URL+"float^"+r:RESNET50_BASE_URL+"quant"+t+"\^"+r}function
mobileNetCheckpoint(e,t,r){var n={1:"100",.75:"075",.5:"050"},o="model-stride"+e+"\json";return
4==r?MOBILENET_BASE_URL+"float^"+n[t+"\^"+o:MOBILENET_BASE_URL+"quant"+r+"\^"+n[t+"\^"+
o]}function toFloatIfInt$1(e){return
tidy(function(){var t=scalar("int32")==e.dtype&&(e=e.toFloat());var t=tensor([-123.15,-115.9,-103.06]);return e.add(t)})}var
ResNet=function(){function e(e,t){this.model=e;var r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-
1===r[2],function(){return"Input shape ["+r[1]+", "+r[2]+"] must both be equal to or -
1"}),this.outputStride=t}return e.prototype.predict=function(e){var t=this;return tidy(function(){var
r=toFloatIfInt$1(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2];return {heatmapScores:n[3].squeeze().
sigmoid(),offsets:s.squeeze(),displacementFwd:o.squeeze(),displacementBwd:i.squeeze()}}),e.prototype.dispose=f
unction(){this.model.dispose();e()};MOBILENET_V1_CONFIG={architecture:"MobileNetV1",outputStride:16,
multiplier:.75,inputResolution:257},VALID_ARCHITECTURE=["MobileNetV1","ResNet50"],VALID_STRID
E={MobileNetV1:[8,16,32],ResNet50:[32,16]},VALID_INPUT_RESOLUTION=[161,193,257,289,321,353,385,41
7,449,481,513,801],VALID_MULTIPLIER={MobileNetV1:[.5,.75,1],ResNet50:[1]},VALID_QUANT_BYTES=[1
,2,4];function
validateModelConfig(e){if(null==(e=e||MOBILENET_V1_CONFIG).architecture&&(e.architecture="MobileNetV
1"),VALID_ARCHITECTURE.indexOf(e.architecture)<0)throw new Error("Invalid architecture
"+e.architecture+". Should be one of
"+VALID_ARCHITECTURE);if(null==e.inputResolution&&(e.inputResolution=257),VALID_INPUT_RESOLU
TION.indexOf(e.inputResolution)<0)throw new Error("Invalid inputResolution "+e.inputResolution+". Should be
one of
"+VALID_INPUT_RESOLUTION);if(null==e.outputStride&&(e.outputStride=16),VALID_STRIDE[e.architectur
e].indexOf(e.outputStride)<0)throw new Error("Invalid outputStride "+e.outputStride+". Should be one of
"+VALID_STRIDE[e.architecture]+"] for architectre
"+e.architecture+");if(null==e.multiplier&&(e.multiplier=1),VALID_MULTIPLIER[e.architecture].indexOf(e.
multiplier)<0)throw new Error("Invalid multiplier "+e.multiplier+". Should be one of

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\'+VALID_MULTIPLIER[e.architecture]+\'' for architectre
\'+e.architecture+\'.\');if(null==e.quantBytes&&(e.quantBytes=4),VALID_QUANT_BYTES.indexOf(e.quantByte
s)<0)throw
 new Error(\'Invalid quantBytes \''+e.quantBytes+\'. Should be one of \''+VALID_QUANT_BYTES+\'' for
 architectre \''+e.architecture+\'.\');return e }var
SINGLE_PERSON_INFERENCE_CONFIG={flipHorizontal:!1},MULTI_PERSON_INFERENCE_CONFIG={fli
pHorizontal:!1,maxDetections:5,scoreThreshold:.5,nmsRadius:20};function validateMultiPersonInputConfig(e){var
t=e.maxDetections,r=e.scoreThreshold,n=e.nmsRadius;if(t<=0)throw new Error(\'Invalid maxDetections \''+t+\'.
Should be > 0\');if(r<0||r>1)throw new Error(\'Invalid scoreThreshold \''+r+\'. Should be in range [0.0,
1.0]\');if(n<=0)throw new Error(\'Invalid nmsRadius \''+n+\'.\')}var PoseNet=function(){function
e(e,t){this.baseModel=e,this.inputResolution=t}return e.prototype.estimateMultiplePoses=function(e,t){return void
0===t&&(t=MULTI_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_,I,E,v,N,y;return
 __generator(this,function(T){switch(T.label){case 0:return
r=__assign({ },MULTI_PERSON_INFERENCE_CONFIG,t),validateMultiPersonInputConfig(t),n=this.baseModel.
outputStride,o=this.inputResolution,assertValidOutputStride(n),assertValidResolution(this.inputResolution,n),i=getI
nputTensorDimensions(e),s=i[0],a=i[1],u=padAndResizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predi
ct(l),d=c.heatmapScores,p=c.offsets,h=c.displacementFwd,m=c.displacementBwd,[4,toTensorBuffers3D([d,p,h,m])]
);case 1:return
g=T.sent(),_=g[0],I=g[1],E=g[2],v=g[3],[4,decodeMultiplePoses(_,I,E,v,n,r.maxDetections,r.scoreThreshold,r.nmsR
adius)];case 2:return
N=T.sent(),y=scaleAndFlipPoses(N,[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,y] } })),e.prototype.estimateSinglePose=function(e,t){return void
0===t&&(t=SINGLE_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_;return __generator(this,function(I){switch(I.label){case
0:return
0:;return
r=__assign({ },SINGLE_PERSON_INFERENCE_CONFIG,t),n=this.baseModel.outputStride,o=this.inputResolutio
n,assertValidOutputStride(n),assertValidResolution(o,n),i=getInputTensorDimensions(e),s=i[0],a=i[1],u=padAndRe
sizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predict(l),d=c.heatmapScores,p=c.offsets,h=c.displacemen
tFwd,m=c.displacementBwd,[4,decodeSinglePose(d,p,n)];case 1:return
g=I.sent(),_=scaleAndFlipPoses([g],[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,_[0]] } })),e.prototype.estimatePoses=function(e,t){return __awaiter(this,void 0,void 0,function(){return
__generator(this,function(r){switch(r.label){case 0:return\'single-
person\'!=t.decodingMethod?[3,2]:[4,this.estimateSinglePose(e,t)];case 1:return[2,[r.sent()]];case
2:return[2,this.estimateMultiplePoses(e,t)] } })),e.prototype.dispose=function(){this.baseModel.dispose(),e()};fun
ction loadMobileNet(e){return __awaiter(this,void 0,void 0,function(){var
t,r,n,o,i,s;return __generator(this,function(a){switch(a.label){case
0;if(t=e.outputStride,r=e.quantBytes,n=e.multiplier,null==tf)throw new Error(\'Cannot find TensorFlow.js. If you
are using a <script> tag, please also include @tensorflow/tfjs on the page before using this\\n model.\');return
o=mobileNetCheckpoint(t,r),[4,loadGraphModel(e.modelUrl||o)];case 1:return i=a.sent(),s=new
MobileNet(i,t),[2,new PoseNet(s,e.inputResolution)] } } })}function loadResNet(e){return __awaiter(this,void 0,void
0,function(){var t,r,n,o,i;return __generator(this,function(s){switch(s.label){case
0;if(t=e.outputStride,r=e.quantBytes,null==tf)throw new Error(\'Cannot find TensorFlow.js. If you are using a
<script> tag, please also include @tensorflow/tfjs on the page before using this\\n model.\');return
n=resNet50Checkpoint(t,r),[4,loadGraphModel(e.modelUrl||n)];case 1:return o=s.sent(),i=new ResNet(o,t),[2,new
PoseNet(i,e.inputResolution)] } } })}function load(e){return void
0===e&&(e=MOBILENET_V1_CONFIG),__awaiter(this,void

```

```

0,void 0,function(){return
__generator(this,function(t){return"ResNet50"===(e=validateModelConfig(e)).architecture?[2,loadResNet(e)]:"M
obileNetV1"===e.architecture?[2,loadMobileNet(e)]:[2,null]}})}export{decodeMultiplePoses,decodeSinglePose,
MobileNet,partChannels,partIds,partNames,poseChain,load,PoseNet,VALID_INPUT_RESOLUTION,getAdjacent
KeyPoints,getBoundingBox,getBoundingBoxPoints,scalePose};\n","/*\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
https://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport * as posenet from '@tensorflow-models/posenet';\nimport * as tf from '@tensorflow/tfjs-core';\n\nconst
COLOR = 'aqua';\nconst BOUNDING_BOX_COLOR = 'red';\nconst LINE_WIDTH = 2;\n\nexport const
TRY_RESNET_BUTTON_NAME = 'tryResNetButton';\nexport const TRY_RESNET_BUTTON_TEXT = '[New]
Try ResNet50';\nconst TRY_RESNET_BUTTON_TEXT_CSS = 'width:100%;text-decoration:underline;';\nconst
TRY_RESNET_BUTTON_BACKGROUND_CSS = 'background:#e61d5f;'\n\nfunction isAndroid() {\n return
/Android/i.test(navigator.userAgent);\n}\n\nfunction isiOS() {\n return
/iPhone/iPad/iPod/i.test(navigator.userAgent);\n}\n\nexport function isMobile() {\n return isAndroid() ||
isiOS();\n}\n\nfunction setDatGuiPropertyCss(propertyText, liCssString, spanCssString = "") {\n var spans =
document.getElementsByClassName('property-name');\n for
(var i = 0; i < spans.length; i++) {\n var text = spans[i].textContent || spans[i].innerText;\n if (text ==
propertyText) {\n spans[i].parentNode.parentNode.style = liCssString;\n if (spanCssString !== "") {\n
spans[i].style = spanCssString;\n } }\n }\n}\n\nexport function updateTryResNetButtonDatGuiCss() {\n
setDatGuiPropertyCss(\n TRY_RESNET_BUTTON_TEXT,
TRY_RESNET_BUTTON_BACKGROUND_CSS,\n TRY_RESNET_BUTTON_TEXT_CSS);\n}\n\n/**\n *
Toggles between the loading UI and the main canvas UI.\n *\nexport function toggleLoadingUI(\n
showLoadingUI, loadingDivId = 'loading', mainDivId = 'main') {\n if (showLoadingUI) {\n
document.getElementById(loadingDivId).style.display = 'block';\n
document.getElementById(mainDivId).style.display = 'none';\n } else {\n
document.getElementById(loadingDivId).style.display = 'none';\n
document.getElementById(mainDivId).style.display = 'block';\n }\n}\n\nexport function drawPoint(ctx, y, x, r,
color)
{\n ctx.beginPath();\n ctx.arc(x, y, r, 0, 2 * Math.PI);\n ctx.fillStyle = color;\n ctx.fill();\n}\n\n/**\n * Draws a
line on a canvas, i.e. a joint\n *\nexport function drawSegment([ay, ax], [by, bx], color, scale, ctx) {\n
ctx.beginPath();\n ctx.moveTo(ax * scale, ay * scale);\n ctx.lineTo(bx * scale, by * scale);\n ctx.lineWidth =
LINE_WIDTH;\n ctx.strokeStyle = color;\n ctx.stroke();\n}\n\n/**\n * Draws a pose skeleton by looking up all
adjacent keypoints/joints\n *\nexport function drawSkeleton(keypoints, minConfidence, ctx, scale = 1) {\n const
adjacentKeyPoints = \n posenet.getAdjacentKeyPoints(keypoints, minConfidence);\n\n function toTuple({y, x})
{\n return [y, x];\n }\n\n adjacentKeyPoints.forEach((keypoints) => {\n drawSegment(\n
toTuple(keypoints[0].position), toTuple(keypoints[1].position), COLOR,\n scale, ctx);\n });\n}\n\n/**\n *
Draw pose keypoints onto a canvas\n *\nexport function drawKeypoints(keypoints, minConfidence,
ctx, scale = 1) {\n for (let i = 0; i < keypoints.length; i++) {\n const keypoint = keypoints[i];\n\n if
(keypoint.score < minConfidence) {\n continue;\n }\n\n const {y, x} = keypoint.position;\n drawPoint(ctx,
y * scale, x * scale, 3, COLOR);\n }\n}\n\n/**\n * Draw the bounding box of a pose. For example, for a whole
person standing\n * in an image, the bounding box will begin at the nose and extend to one of\n * ankles\n
*\nexport function drawBoundingBox(keypoints, ctx) {\n const boundingBox =
posenet.getBoundingBox(keypoints);\n\n ctx.rect(\n boundingBox.minX, boundingBox.minY,

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boundingBox.maxX - boundingBox.minX,\n boundingBox.maxY - boundingBox.minY);\n\n ctx.strokeStyle =
boundingBoxColor;\n ctx.stroke();\n}\n\n/**\n * Converts an array of pixel data into an ImageData object\n
*/\n\nexport async function renderToCanvas(a, ctx) {\n const [height, width] = a.shape;\n const imageData = new
ImageData(width, height);\n\n const data = await a.data();\n\n for (let i = 0; i < height * width; ++i) {\n const j = i * 4;\n const k = i * 3;\n\n imageData.data[j + 0] = data[k
+ 0];\n imageData.data[j + 1] = data[k + 1];\n imageData.data[j + 2] = data[k + 2];\n imageData.data[j + 3] =
255;\n }\n\n ctx.putImageData(imageData, 0, 0);\n}\n\n/**\n * Draw an image on a canvas\n
*/\n\nexport function
renderImageToCanvas(image, size, canvas) {\n canvas.width = size[0];\n canvas.height = size[1];\n const ctx =
canvas.getContext('2d');\n\n ctx.drawImage(image, 0, 0);\n}\n\n/**\n * Draw heatmap values, one of the model
outputs, on to the canvas\n
* Read our blog post for a description of PoseNet's heatmap outputs\n
*
https://medium.com/tensorflow/real-time-human-pose-estimation-in-the-browser-with-tensorflow-js-7dd0bc881cd5\n
*/\n\nexport function
drawHeatMapValues(heatMapValues, outputStride, canvas) {\n const ctx =
canvas.getContext('2d');\n const radius = 5;\n const scaledValues = heatMapValues.mul(tf.scalar(outputStride,
'int32'));\n drawPoints(ctx, scaledValues, radius, COLOR);\n}\n\n/**\n * Used by the drawHeatMapValues
method to draw heatmap points on to\n
* the canvas\n
*/\n\nfunction
drawPoints(ctx, points, radius, color) {\n const
data = points.buffer().values;\n\n for (let i = 0; i < data.length; i += 2) {\n const pointY = data[i];\n const pointX
= data[i + 1];\n\n if (pointX !== 0 && pointY !== 0) {\n ctx.beginPath();\n ctx.arc(pointX, pointY, radius,
0, 2 * Math.PI);\n ctx.fillStyle = color;\n ctx.fill();\n }\n }\n}\n\n/**\n * Draw offset vector values, one of
the model outputs, on to the canvas\n
* Read our blog post for a description of PoseNet's offset vector outputs\n
*
https://medium.com/tensorflow/real-time-human-pose-estimation-in-the-browser-with-tensorflow-js-7dd0bc881cd5\n
*/\n\nexport function
drawOffsetVectors(\n heatMapValues, offsets, outputStride, scale = 1, ctx)
{\n const offsetPoints =\n posenet.singlePose.getOffsetPoints(heatMapValues,
outputStride, offsets);\n\n const heatmapData = heatMapValues.buffer().values;\n const offsetPointsData =
offsetPoints.buffer().values;\n\n for (let i = 0; i < heatmapData.length; i += 2) {\n const heatmapY =
heatmapData[i] * outputStride;\n const heatmapX = heatmapData[i + 1] * outputStride;\n const offsetPointY =
offsetPointsData[i];\n const offsetPointX = offsetPointsData[i + 1];\n\n drawSegment(\n [heatmapY,
heatmapX], [offsetPointY, offsetPointX], COLOR, scale, ctx);\n }\n}\n\n",/**\n * @license\n
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OF ANY KIND, either express or implied.\n
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and\n
* limitations under the License.\n
*/\n
}

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=====
color schemes generated using d3-scale-chromatic:\n//
https://github.com/d3/d3-scale-chromatic\n\nexport const
rainbow = [\n [110, 64, 170], [143, 61, 178], [178, 60, 178], [210, 62, 167],\n [238, 67, 149], [255, 78, 125], [255,
94, 99], [255, 115, 75],\n [255, 140, 56], [239, 167, 47], [217, 194, 49], [194, 219, 64],\n [175, 240, 91], [135, 245,
87], [96, 247, 96], [64, 243, 115],\n [40, 234, 141], [28, 219, 169], [26, 199, 194], [33, 176, 213],\n [47, 150, 224],
[65, 125, 224], [84, 101, 214], [99, 81, 195];\n\nexport const warm = [\n [110, 64, 170], [106, 72, 183], [100, 81,
196], [92, 91, 206],\n [84, 101, 214], [75, 113, 221], [66, 125, 224], [56, 138, 226],\n [48, 150, 224], [40, 163,
220], [33, 176, 214], [29, 188, 205],\n [26, 199, 194], [26, 210, 182], [28, 219, 169], [33, 227, 155],\n [41, 234, 141], [51, 240, 128], [64, 243, 116], [79,
246, 105],\n [96, 247, 97], [115, 246, 91], [134, 245, 88], [155, 243, 88];\n\nexport const spectral = [\n [158, 1,
66], [181, 26, 71], [202, 50, 74], [219, 73, 74],\n [232, 94, 73], [242, 117, 75], [248, 142, 83], [251, 167,
96],\n [253, 190, 112], [254, 210, 129], [254, 227, 149], [254, 240, 166],\n [251, 248, 176], [243, 249, 172], [231,
245, 163], [213, 238, 159],\n [190, 229, 160], [164, 218, 163], [137, 207, 165], [110, 192, 168],\n [86, 173, 174],
[70, 150, 179], [67, 127, 180], [77, 103, 173];\n\n",/**\n * @license\n
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```
=====\n*\nimport '@tensorflow/tfjs-backend-webgl';\nimport * as bodyPix from '@tensorflow-models/body-pix';\nimport dat from 'dat.gui';\nimport Stats from 'stats.js';\nimport {drawKeypoints, drawSkeleton, toggleLoadingUI, TRY_RESNET_BUTTON_NAME, TRY_RESNET_BUTTON_TEXT, updateTryResNetButtonDatGuiCss} from './demo_util';\nimport * as partColorScales from './part_color_scales';\n\nconst stats = new Stats();\nconst state = {\n video: null,\n stream: null,\n net: null,\n videoConstraints: {},\n // Triggers the TensorFlow model to reload\n changingArchitecture: false,\n changingMultiplier: false,\n changingStride: false,\n changingResolution: false,\n changingQuantBytes: false,\n};\n\nfunction isAndroid() {\n return /Android/i.test(navigator.userAgent);\n}\n\nfunction isiOS() {\n return /iPhone|iPod/i.test(navigator.userAgent);\n}\n\nfunction isMobile() {\n return isAndroid() || isiOS();\n}\n\nasync function getVideoInputs() {\n if (!navigator.mediaDevices || !navigator.mediaDevices.enumerateDevices) {\n console.log('enumerateDevices() not supported.);\n return [];\n }\n\n const devices = await navigator.mediaDevices.enumerateDevices();\n const videoDevices = devices.filter(device => device.kind === 'videoinput');\n return videoDevices;\n}\n\nfunction stopExistingVideoCapture() {\n if (state.video && state.video.srcObject) {\n state.video.srcObject.getTracks().forEach(track => {\n track.stop();\n });\n state.video.srcObject = null;\n }\n}\n\nasync function getDeviceIdForLabel(cameraLabel) {\n const videoInputs = await getVideoInputs();\n let i = 0; i < videoInputs.length; i++) {\n const videoInput = videoInputs[i];\n if (videoInput.label === cameraLabel) {\n return videoInput.deviceId;\n }\n }\n return null;\n}\n\n// on mobile, facing mode is the preferred way to select a camera.\n// Here we use the camera label to determine if its the environment or\n// user facing camera\nfunction getFacingMode(cameraLabel) {\n if (!cameraLabel) {\n return 'user';\n }\n if (cameraLabel.toLowerCase().includes('back')) {\n return 'environment';\n } else {\n return 'user';\n }\n}\n\nasync function getConstraints(cameraLabel) {\n let deviceId;\n let facingMode;\n if (cameraLabel) {\n deviceId = await getDeviceIdForLabel(cameraLabel);\n // on mobile, use the facing mode based on the camera.\n facingMode = isMobile() ? getFacingMode(cameraLabel) : null;\n }\n return {deviceId, facingMode};\n}\n\n/**\n * Loads a the camera to be used in the demo\n */\nasync function setupCamera(cameraLabel) {\n if (!navigator.mediaDevices || !navigator.mediaDevices.getUserMedia) {\n throw new Error('Browser API navigator.mediaDevices.getUserMedia not available');\n }\n\n const videoElement = document.getElementById('video');\n stopExistingVideoCapture();\n const videoConstraints = await getConstraints(cameraLabel);\n const stream = await navigator.mediaDevices.getUserMedia({\n 'audio': false,\n 'video': videoConstraints});\n videoElement.srcObject = stream;\n return new Promise((resolve) => {\n videoElement.onloadedmetadata = () => {\n videoElement.width = videoElement.videoWidth;\n videoElement.height = videoElement.videoHeight;\n resolve(videoElement);\n }; \n });\n}\n\nasync function loadVideo(cameraLabel) {\n try {\n state.video = await setupCamera(cameraLabel);\n } catch (e) {\n let info = document.getElementById('info');\n info.textContent = 'this browser does not support video capture,' +\n 'or this device does not have a camera';\n info.style.display = 'block';\n throw e;\n }\n state.video.play();\n}\n\nconst defaultQuantBytes = 2;\nconst defaultMobileNetMultiplier = isMobile() ? 0.50 : 0.75;\nconst defaultMobileNetStride = 16;\nconst defaultMobileNetInternalResolution = 'medium';\nconst defaultResNetMultiplier = 1.0;\nconst defaultResNetStride = 16;\nconst defaultResNetInternalResolution = 'low';\nconst guiState = {\n algorithm: 'multi-person-instance',\n estimate: 'partmap',\n camera: null,\n
```

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flipHorizontal: true,\n input: {\n architecture: 'MobileNetV1',\n outputStride: 16,\n internalResolution: 'low',\n multiplier: 0.50,\n quantBytes: 2\n },\n multiPersonDecoding: {\n maxDetections: 5,\n scoreThreshold: 0.3,\n nmsRadius: 20,\n numKeypointForMatching: 17,\n refineSteps: 10\n },\n segmentation: {\n segmentationThreshold: 0.7,\n effect: 'mask',\n maskBackground: true,\n opacity: 0.7,\n backgroundBlurAmount: 3,\n maskBlurAmount: 0,\n edgeBlurAmount: 3\n },\n partMap: {\n colorScale: 'rainbow',\n effect: 'partMap',\n segmentationThreshold: 0.5,\n opacity: 0.9,\n blurBodyPartAmount: 3,\n bodyPartEdgeBlurAmount: 3\n },\n showFps: lisMobile()\n};\n\nfunction toCameraOptions(cameras) {\n const result = {default: null};\n cameras.forEach(camera => {\n result[camera.label] = camera.label;\n })\n return result;\n}\n\n/**\n * Sets up dat.gui controller on the top-right of the window\n */\nfunction setupGui(cameras) {\n const gui = new dat.GUI({width: 300});\n let architectureController = null;\n guiState[TRY_RESNET_BUTTON_NAME] = function() {\n architectureController.setValue('ResNet50')\n }; \n gui.add(guiState, TRY_RESNET_BUTTON_NAME).name(TRY_RESNET_BUTTON_TEXT);\n updateTryResNetButtonDatGuiCss();\n gui.add(guiState, 'camera', toCameraOptions(cameras))\n .onChange(async function(cameraLabel) {\n state.changingCamera = true;\n await loadVideo(cameraLabel);\n state.changingCamera = false;\n });\n gui.add(guiState, 'flipHorizontal');\n // There are two algorithms 'person' and 'multi-person-instance'.\n // The 'person' algorithm returns one single segmentation mask (or body\n // part map) for all people in the image. The 'multi-person-instance'\n // algorithm returns an array of segmentation mask (or body part map).\n // Each element in the array corresponding to one of the people. In other\n // words, 'multi-person-instance' algorithm does instance-level person\n // segmentation and body part segmentation for every person in the image.\n const algorithmController =\n gui.add(guiState, 'algorithm', ['person', 'multi-person-instance']);\n // Architecture: there are a few BodyPix models varying in size and\n // accuracy.\n // The input parameters have the most effect on accuracy and speed of the\n // network\n let input = gui.addFolder('Input');\n // Updates outputStride\n // Output stride: Internally, this parameter affects the height and width\n // of the layers in the neural network. The lower the value of the output\n // stride the higher the accuracy but slower the speed, the higher the\n // value the faster the speed but lower the accuracy.\n let outputStrideController = null;\n function updateGuiOutputStride(outputStride, outputStrideArray) {\n if (outputStrideController) {\n outputStrideController.remove();\n }\n guiState.input.outputStride = outputStride;\n outputStrideController =\n input.add(guiState.input, 'outputStride', outputStrideArray);\n outputStrideController.onChange(function(outputStride) {\n state.changingStride = true;\n guiState.input.outputStride = +outputStride;\n });\n }\n // Updates internal resolution\n // Internal resolution: Internally, this parameter affects the height and\n // width of the layers in the neural network. The higher the value of the\n // internal resolution the better the accuracy but slower the speed.\n let internalResolutionController = null;\n function updateGuiInternalResolution(\n internalResolution,\n internalResolutionArray,\n) {\n if (internalResolutionController) {\n internalResolutionController.remove();\n }\n guiState.input.internalResolution = internalResolution;\n internalResolutionController = input.add(\n guiState.input, 'internalResolution', internalResolutionArray);\n internalResolutionController.onChange(function(internalResolution) {\n guiState.input.internalResolution =\n internalResolution;\n });\n }\n // Updates depth multiplier\n // Multiplier: this parameter affects the number of feature map channels\n // in the MobileNet. The higher the value, the higher the accuracy but\n // slower the speed, the lower the value the faster the speed but lower\n // the accuracy.\n let multiplierController = null;\n function updateGuiMultiplier(multiplier, multiplierArray) {\n if (multiplierController) {\n multiplierController.remove();\n }\n guiState.input.multiplier = multiplier;\n multiplierController =\n input.add(guiState.input, 'multiplier', multiplierArray);\n multiplierController.onChange(function(multiplier) {\n state.changingMultiplier = true;\n guiState.input.multiplier = +multiplier;\n });\n }\n // updates quantBytes\n // QuantBytes: this parameter

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affects weight quantization in the ResNet50 // model. The available options are 1 byte, 2 bytes, and 4 bytes. The
// higher the value, the larger the model size and thus the longer the
// loading time, the lower the value, the shorter the loading time but
// lower the accuracy.
let quantBytesController = null;
function updateGuiQuantBytes(quantBytes, quantBytesArray) {
 if (quantBytesController) {
 quantBytesController.remove();
 }
 guiState.quantBytes = +quantBytes;
 guiState.input.quantBytes = +quantBytes;
 quantBytesController =
 input.add(guiState.input, 'quantBytes', quantBytesArray);
 quantBytesController.onChange(function(quantBytes) {
 state.changingQuantBytes = true;
 guiState.input.quantBytes = +quantBytes;
 });
}

function updateGuiInputSection() {
 if (guiState.input.architecture === 'MobileNetV1') {
 updateGuiInternalResolution(
 defaultMobileNetInternalResolution,
 ['low', 'medium', 'high', 'full']);
 updateGuiOutputStride(defaultMobileNetStride, [8, 16]);
 updateGuiMultiplier(defaultMobileNetMultiplier, [0.50, 0.75, 1.0]);
 } else { // guiState.input.architecture === 'ResNet50'
 updateGuiInternalResolution(
 defaultResNetInternalResolution, ['low', 'medium', 'high', 'full']);
 updateGuiOutputStride(defaultResNetStride, [32, 16]);
 updateGuiMultiplier(defaultResNetMultiplier, [1.0]);
 }
 updateGuiQuantBytes(defaultQuantBytes, [1, 2, 4]);
}

// Architecture:
there are a few PoseNet models varying in size and // accuracy. 1.01 is the largest, but will be the slowest. 0.50 is
the // fastest, but least accurate.
architectureController =
 input.add(guiState.input, 'architecture', ['ResNet50', 'MobileNetV1']);
guiState.architecture = guiState.input.architecture;
architectureController.onChange(function(architecture) {
 // if architecture is ResNet50, then show ResNet50
 options
 state.changingArchitecture = true;
 guiState.input.architecture = architecture;
 updateGuiInputSection();
});

updateGuiInputSection();
input.open();

const estimateController =
 gui.add(guiState, 'estimate', ['segmentation', 'partmap']);
let segmentation = gui.addFolder('Segmentation');
segmentation.add(guiState.segmentation, 'segmentationThreshold', 0.0, 1.0);
const segmentationEffectController =
 segmentation.add(guiState.segmentation, 'effect', ['mask', 'bokeh']);
let multiPersonDecoding =
 gui.addFolder('MultiPersonDecoding');
multiPersonDecoding.add(
 guiState.multiPersonDecoding, 'maxDetections', 0, 20, 1);
multiPersonDecoding.add(
 guiState.multiPersonDecoding, 'scoreThreshold', 0.0, 1.0);
multiPersonDecoding.add(
 guiState.multiPersonDecoding, 'nmsRadius', 0, 30, 1);
multiPersonDecoding.add(
 guiState.multiPersonDecoding, 'numKeypointForMatching', 1, 17, 1);
multiPersonDecoding.add(
 guiState.multiPersonDecoding, 'refineSteps', 1, 10, 1);
multiPersonDecoding.open();

algorithmController.onChange(function(value) {
 switch (guiState.algorithm) {
 case 'single-person':
 multiPersonDecoding.close();
 singlePersonDecoding.open();
 break;
 case 'multi-person':
 singlePersonDecoding.close();
 multiPersonDecoding.open();
 break;
 }
});

let darknessLevel;
let bokehBlurAmount;
let edgeBlurAmount;
let maskBlurAmount;
let maskBackground;
segmentationEffectController.onChange(function(effectType) {
 if (effectType === 'mask') {
 if (bokehBlurAmount) {
 bokehBlurAmount.remove();
 }
 if (edgeBlurAmount) {
 edgeBlurAmount.remove();
 }
 darknessLevel =
 segmentation.add(guiState.segmentation, 'opacity', 0.0, 1.0);
 maskBlurAmount =
 segmentation.add(guiState.segmentation, 'maskBlurAmount')
 .min(0)
 .max(20)
 .step(1);
 maskBackground =
 segmentation.add(guiState.segmentation, 'maskBackground');
 } else if (effectType === 'bokeh') {
 if (darknessLevel) {
 darknessLevel.remove();
 }
 if (maskBlurAmount) {
 maskBlurAmount.remove();
 }
 if (maskBackground) {
 maskBackground.remove();
 }
 bokehBlurAmount = segmentation
 .add(
 guiState.segmentation,
 'backgroundBlurAmount',
)
 .min(1)
 .max(20)
 .step(1);
 edgeBlurAmount = segmentation.add(guiState.segmentation, 'edgeBlurAmount')
 .min(0)
 .max(20)
 .step(1);
 }
});

// manually set the effect so that the options are shown.

```

```

segmentationEffectController.setValue(guiState.segmentation.effect);\n\n let partMap = gui.addFolder('Part
Map');\n partMap.add(guiState.partMap, 'segmentationThreshold', 0.0, 1.0);\n partMap.add(\n guiState.partMap,
'effect', ['partMap', 'pixelation', 'blurBodyPart']);\n partMap.add(guiState.partMap, 'opacity', 0.0, 1.0);\n
partMap.add(guiState.partMap, 'colorScale', Object.keys(partColorScales))\n .onChange(colorScale => {\n
setShownPartColorScales(colorScale);\n });\n setShownPartColorScales(guiState.partMap.colorScale);\n
partMap.add(guiState.partMap, 'blurBodyPartAmount').min(1).max(20).step(1);\n partMap.add(guiState.partMap,
'bodyPartEdgeBlurAmount')\n .min(1)\n .max(20)\n .step(1);\n partMap.open();\n\n
estimateController.onChange(function(estimationType) {\n if (estimationType === 'segmentation') {\n
segmentation.open();\n partMap.close();\n document.getElementById('colors').style.display = 'none';\n }
else {\n segmentation.close();\n partMap.open();\n document.getElementById('colors').style.display =
'inline-block';\n }\n });\n\n gui.add(guiState, 'showFps').onChange(showFps => {\n if (showFps) {\n
document.body.appendChild(stats.dom);\n } else {\n document.body.removeChild(stats.dom);\n }\n
})\n\nfunction setShownPartColorScales(colorScale) {\n const colors = document.getElementById('colors');\n
colors.innerHTML = '';\n\n const partColors = partColorScales[colorScale];\n
const partNames = bodyPix.PART_CHANNELS;\n\n for (let i = 0; i < partColors.length; i++) {\n const
partColor = partColors[i];\n const child = document.createElement('li');\n\n child.innerHTML = `\n <div
class='color' style='background-color:rgb(${partColor[0]},${partColor[1]},${partColor[2]})' ></div>\n
${partNames[i]}`;\n\n colors.appendChild(child);\n }\n\n\n**\n * Sets up a frames per second panel on the top-
left of the window\n *\nfunction setupFPS() {\n stats.showPanel(0); // 0: fps, 1: ms, 2: mb, 3+: custom\n
if (guiState.showFps) {\n document.body.appendChild(stats.dom);\n }\n\n\nasync function estimateSegmentation()
{\n let multiPersonSegmentation = null;\n switch (guiState.algorithm) {\n case 'multi-person-instance':\n
return await state.net.segmentMultiPerson(state.video, {\n internalResolution:
guiState.input.internalResolution,\n segmentationThreshold: guiState.segmentation.segmentationThreshold,\n
maxDetections: guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
numKeypointForMatching: guiState.multiPersonDecoding.numKeypointForMatching,\n refineSteps:
guiState.multiPersonDecoding.refineSteps\n });\n case 'person':\n return await
state.net.segmentPerson(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
});\n default:\n break;\n });\n return multiPersonSegmentation;\n }\n\n\nasync function
estimatePartSegmentation() {\n switch (guiState.algorithm) {\n case 'multi-person-instance':\n return await
state.net.segmentMultiPersonParts(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
numKeypointForMatching: guiState.multiPersonDecoding.numKeypointForMatching,\n refineSteps:
guiState.multiPersonDecoding.refineSteps\n });\n case 'person':\n return await
state.net.segmentPersonParts(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
});\n
default:\n break;\n });\n return multiPersonPartSegmentation;\n }\n\nfunction
drawPoses(personOrPersonPartSegmentation, flipHorizontally, ctx) {\n if
(Array.isArray(personOrPersonPartSegmentation)) {\n
personOrPersonPartSegmentation.forEach(personSegmentation => {\n let pose = personSegmentation.pose;\n

```



```

if (flipHorizontally) {\n pose = bodyPix.flipPoseHorizontal(pose, personSegmentation.width);\n }\n
drawKeypoints(pose.keypoints, 0.1, ctx);\n drawSkeleton(pose.keypoints, 0.1, ctx);\n });\n } else {\n
personOrPersonPartSegmentation.allPoses.forEach(pose => {\n if (flipHorizontally) {\n pose =
bodyPix.flipPoseHorizontal(\n pose, personOrPersonPartSegmentation.width);\n }\n
drawKeypoints(pose.keypoints, 0.1, ctx);\n drawSkeleton(pose.keypoints, 0.1, ctx);\n });\n }\n}\n\n\nasync
function loadBodyPix() {\n toggleLoadingUI(true);\n state.net = await bodyPix.load({\n architecture:
guiState.input.architecture,\n
 outputStride: guiState.input.outputStride,\n multiplier: guiState.input.multiplier,\n quantBytes:
guiState.input.quantBytes\n });\n toggleLoadingUI(false);\n }\n\n\n**\n * Feeds an image to BodyPix to estimate
segmentation - this is where the\n * magic happens. This function loops with a requestAnimationFrame method.\n
*\n\nfunction segmentBodyInRealTime() {\n const canvas = document.getElementById('output');\n // since images
are being fed from a webcam\n\n async function bodySegmentationFrame() {\n // if changing the model or the
camera, wait a second for it to complete\n // then try again.\n if (state.changingArchitecture ||
state.changingMultiplier ||\n state.changingCamera || state.changingStride ||\n state.changingQuantBytes)
{\n console.log('load model...');\n loadBodyPix();\n state.changingArchitecture = false;\n
state.changingMultiplier = false;\n state.changingStride = false;\n state.changingQuantBytes
= false;\n }\n\n // Begin monitoring code for frames per second\n stats.begin();\n\n const flipHorizontally =
guiState.flipHorizontal;\n\n switch (guiState.estimate) {\n case 'segmentation':\n const
multiPersonSegmentation = await estimateSegmentation();\n switch (guiState.segmentation.effect) {\n
case 'mask':\n const ctx = canvas.getContext('2d');\n const foregroundColor = {r: 255, g: 255, b: 255,
a: 255};\n const backgroundColor = {r: 0, g: 0, b: 0, a: 255};\n const mask = bodyPix.toMask(\n
multiPersonSegmentation, foregroundColor, backgroundColor,\n true);\n\n bodyPix.drawMask(\n
canvas, state.video, mask, guiState.segmentation.opacity,\n
guiState.segmentation.maskBlurAmount, flipHorizontally);\n drawPoses(multiPersonSegmentation,
flipHorizontally, ctx);\n break;\n case 'bokeh':\n
bodyPix.drawBokehEffect(\n canvas, state.video, multiPersonSegmentation,\n
+guiState.segmentation.backgroundBlurAmount,\n guiState.segmentation.edgeBlurAmount,
flipHorizontally);\n break;\n }\n\n break;\n case 'partmap':\n const ctx =
canvas.getContext('2d');\n const multiPersonPartSegmentation = await estimatePartSegmentation();\n const
coloredPartImageData = bodyPix.toColoredPartMask(\n multiPersonPartSegmentation,\n
partColorScales[guiState.partMap.colorScale]);\n\n const maskBlurAmount = 0;\n switch
(guiState.partMap.effect) {\n case 'pixelation':\n const pixelCellWidth = 10.0;\n\n
bodyPix.drawPixelatedMask(\n canvas, state.video, coloredPartImageData,\n
guiState.partMap.opacity, maskBlurAmount, flipHorizontally,\n pixelCellWidth);\n break;\n
case 'partMap':\n
bodyPix.drawMask(\n canvas, state.video, coloredPartImageData, guiState.opacity,\n
maskBlurAmount, flipHorizontally);\n break;\n case 'blurBodyPart':\n const blurBodyPartIds =
[0, 1];\n bodyPix.blurBodyPart(\n canvas, state.video, multiPersonPartSegmentation,\n
blurBodyPartIds, guiState.partMap.blurBodyPartAmount,\n guiState.partMap.edgeBlurAmount,
flipHorizontally);\n }\n drawPoses(multiPersonPartSegmentation, flipHorizontally, ctx);\n break;\n
default:\n break;\n }\n\n // End monitoring code for frames per second\n stats.end();\n\n
requestAnimationFrame(bodySegmentationFrame);\n }\n\n bodySegmentationFrame();\n }\n\n\n**\n * Kicks off the
demo.\n\n*\n\nexport async function bindPage() {\n // Load the BodyPix model weights with architecture 0.75\n
await loadBodyPix();\n document.getElementById('loading').style.display
= 'none';\n document.getElementById('main').style.display = 'inline-block';\n\n await
loadVideo(guiState.camera);\n\n let cameras = await getVideoInputs();\n setupFPS();\n setupGui(cameras);\n\n
segmentBodyInRealTime();\n }\n\n\nnavigator.getUserMedia = navigator.getUserMedia ||\n
navigator.webkitGetUserMedia || navigator.mozGetUserMedia;\n\n// kick off the demo\nbindPage();\n"}

```

Found in path(s):

\* /opt/cola/permits/1234600288\_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/demos/dist/demos.ab0c720b.js.map

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* =====
*/

```

Found in path(s):

```

* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.js

```

## 1.239 chardet 3.0.4

## 1.239.1 Available under license :

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Version 2.1, February 1999

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\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AllValuesIterator.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Base64Helper.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/IntCountsHistogram.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleLinearIterator.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedConcurrentDoubleHistogram.java

\*

/opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SynchronizedHistogram.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/packedarray/PackedArraySingleWriterRecorder.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Histogram.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/LogarithmicIterator.java

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Version.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/RecordedValuesIterator.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/LinearIterator.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedDoubleHistogram.java  
\*  
/opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AtomicHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramIterationValue.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Recorder.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/ConcurrentDoubleHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramLogReader.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramLogProcessor.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SingleWriterDoubleRecorder.java  
\*  
/opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleRecorder.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleHistogramIterationValue.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AbstractHistogramIterator.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SynchronizedDoubleHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PercentileIterator.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedConcurrentHistogram.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleRecordedValuesIterator.java  
\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleAllValuesIterator.java  
\*  
/opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SingleWriterRecorder.java  
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\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/ShortCountsHistogram.java



```
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/EncodableHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/HistogramLogScanner.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/packedarray/PackedArrayRecorder.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
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jar/org/HdrHistogram/AbstractHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/DoubleHistogram.java
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info.java
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```

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```

```
package org.HdrHistogram;
```

```
final class Version {
 public static final String version="$VERSION$";
 public static final String build_time="$BUILD_TIMES$";
}
```

Found in path(s):

\* /opt/cola/permits/1257203437\_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Version.java.template

## 1.241 hikaricp 3.4.5

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\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariJNDIFactory.java

\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/dropwizard/CodaHaleMetricsTracker.java

\*

/opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/MetricsTracker.java

\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/MetricsTrackerFactory.java

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\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/UtilityElf.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyStatement.java  
\*  
/opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyPreparedStatement.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariDataSource.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusHistogramMetricsTracker.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConnectionProvider.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusMetricsTracker.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConfigurationUtil.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariPoolMXBean.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyCallableStatement.java  
\*  
/opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleMetricsTrackerFactory.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfigMXBean.java  
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\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-

```
jar/com/zaxxer/hikari/util/ConcurrentBag.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyResultSet.java
*
/opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/DriverDataSource.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/SuspendResumeLock.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/JavassistProxyFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfig.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyConnection.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyLeakTaskFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/FastList.java
*
/opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyLeakTask.java
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\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-  
jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleHealthChecker.java  
\* /opt/cola/permits/1257259274\_1642793180.98/0/hikaricp-3-4-5-sources-  
jar/com/zaxxer/hikari/pool/PoolEntry.java

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jar/com/zaxxer/hikari/metrics/prometheus/PrometheusHistogramMetricsTrackerFactory.java

## 1.242 statistics 2.1

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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/stats/DefaultStatisticsRepository.java  
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jar/org/springframework/retry/annotation/RetryConfiguration.java  
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\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/policy/NeverRetryPolicy.java  
\* /opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/retry/support/RetrySimulator.java  
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/opt/cola/permits/1257347829\_1642803596.13/0/spring-retry-1-2-5-release-sources-jar/org/springframework/classify/BackToBackPatternClassifier.java  
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# 1.244 jctools-core 3.0.0

## 1.244.1 Available under license :

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<license>

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License, Version 2.0</name>

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<tag>HEAD</tag>

</scm>

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<url>https://github.com/nitsanw</url>

</developer>

<developer>

<url>https://github.com/mjpt777</url>

</developer>

<developer>

<url>https://github.com/RichardWarburton</url>

</developer>

<developer>

<url>https://github.com/kay</url>

</developer>

<developer>

<url>https://github.com/franz1981</url>

</developer>

</developers>

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<junit.version>4.12</junit.version>
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 \*/

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 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/UnsafeJvmInfo.java  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscAtomicArrayQueue.java  
 \*  
 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscLinkedAtomicQueue.java

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 \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCGrowableArrayQueue.java  
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* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/MessagePassingQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/atomic/SequencedAtomicReferenceArrayQueue.java
*
/opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/BaseSpSCLinkedArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/LinkedQueueNode.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/MpmcArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/UnsafeAccess.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/util/UnsafeRefArrayAccess.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/SpSCChunkedArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/atomic/SpSCUnboundedAtomicArrayQueue.java
* /opt/cola/permits/1257637630_1642977964.98/0/jctools-core-3-0-0-sources-
jar/org/jctools/queues/atomic/AtomicQueueFactory.java

```

## 1.245 jackson-dataformat-yaml 2.11.2

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 */
```

Found in path(s):

```
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
jar/org/fusesource/jansi/internal/Kernel32.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
jar/org/fusesource/jansi/internal/CLibrary.java
```

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```

Found in path(s):

```
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/CLibrary.java
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/Kernel32.java
```

# 1.249 jakarta-el 3.0.3

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## 1.251 jackson-module-parameter-names

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## 1.255 sequence-generator 5.7.3

### 1.255.1 Available under license :

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Manifest-Version: 1.0  
Bnd-LastModified: 1563545580901  
Build-Jdk: 1.8.0\_202  
Built-By: jenkins-slave  
Bundle-Description: A set of Java modules for management and monitoring, common to several Terracotta products  
Bundle-License: <http://www.apache.org/licenses/LICENSE-2.0.txt>  
Bundle-ManifestVersion: 2  
Bundle-Name: Terracotta Management :: Sequence Generator  
Bundle-SymbolicName: org.terracotta.management.sequence-generator  
Bundle-Version: 5.7.3  
Created-By: Apache Maven Bundle Plugin  
Export-Package: org.terracotta.management.sequence;version="5.7.3",org.terracotta.management.sequence.perf;version="5.7.3"  
Main-Class: org.terracotta.management.sequence.perf.PerfTest  
Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.8))"  
Tool: Bnd-2.4.1.201501161923

Found in path(s):

\* /opt/cola/permits/1258059180\_1643027223.49/0/sequence-generator-5-7-3-jar/META-INF/MANIFEST.MF

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\* /opt/cola/permits/1258059180\_1643027223.49/0/sequence-generator-5-7-3-jar/META-INF/maven/org.terracotta.management/sequence-generator/pom.xml

## 1.256 management-model 5.7.3

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Found in path(s):

```
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/message/DefaultManagementCallMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/Sample.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/call/ContextualCall.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/DelegatingStatistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/Descriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/Statistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/context/CapabilityContext.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/call/Parameter.java
```

```

* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/CallDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/ContextualStatistics.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/StatisticDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/DefaultCapability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/ContextContainer.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/Context.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/Capability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/ManagementCallMessage.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/StatisticRegistry.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/DefaultMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/call/ContextualReturn.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/Message.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/cluster/ClientIdentifier.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/Settings.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/notification/ContextualNotification.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/Contextual.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/StatisticType.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/DelegatingSample.java

```

## 1.257 offheap-store 2.4.3

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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/WriteLockedOffHeapHashMapFactory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/AbstractOffHeapClockCache.java  
\*  
/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/AbstractConcurrentOffHeapCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/storage/FileBackedStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/eviction/EvictionListeningReadWriteLockedOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ConcurrentOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapClockCacheFactory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/SplitStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/Segment.java  
\*  
/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/OffHeapBufferHalfStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/paging/PowerOfTwoFileAllocator.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ReadWriteLockedOffHeapHashMapFactory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/PointerSize.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/portability/SerializablePortability.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/allocator/LongBestFitAllocator.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-

jar/org/terracotta/offheapstore/storage/StorageEngine.java  
\*  
/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/PhysicalMemory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/buffersource/TimingBufferSource.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/paging/MappedPageSource.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/paging/PhantomReferenceLimitedPageSource.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/IntegerStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/HashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/AAHashSet.java  
\*  
/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/LongStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/storage/PersistentSplitStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ConcurrentWriteLockedOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/listener/AbstractListenableStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/WeakIdentityHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapHashMapFactory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/paging/UpfrontAllocatingPageSource.java  
\*  
/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/HalfStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ConcurrentWriteLockedOffHeapHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/allocator/PowerOfTwoAllocator.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/Retryer.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ReadWriteLockedOffHeapClockCacheFactory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/OffHeapBufferStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/storage/PersistentIntegerStorageEngine.java  
\*

/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/FindbugsSuppressWarnings.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/AbstractConcurrentOffHeapMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/set/OffHeapHashSet.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/SerializableStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/MetadataTuple.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/PortabilityBasedHalfStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/StringStorageEngine.java  
\*  
/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/storage/AATreeFileAllocator.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/OffHeapHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/PortabilityBasedStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/paging/OffHeapStorageArea.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/util/ByteBufferUtils.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/ConcurrentOffHeapHashMap.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/AbstractLockedOffHeapHashMap.java  
\*  
/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/concurrent/WriteLockedOffHeapClockCacheFactory.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentConcurrentOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/storage/BooleanHalfStorageEngine.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/eviction/EvictionListeningWriteLockedOffHeapClockCache.java  
\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-  
jar/org/terracotta/offheapstore/disk/persistent/PersistentConcurrentOffHeapHashMap.java  
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Found in path(s):

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentConcurrentOffHeapCache.java  
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\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/META-INF/maven/org.terracotta/offheap-store/pom.xml  
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Found in path(s):

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/eviction/EvictionListener.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/DebuggingUtils.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/Allocator.java

\*

/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/BinaryStorageEngine.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/ReadWriteLockedOffHeapHashMap.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/Portability.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentPortability.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableSegment.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/exceptions/OversizeMappingException.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/WriteLockedOffHeapHashMap.java

\*

/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/Validation.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableCache.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/HeapBufferSource.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/OffHeapBufferSource.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/Page.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/Persistent.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentStorageEngine.java

\*

/opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/PageSource.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/RuntimeStorageEngineListener.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/ByteArrayPortability.java

\* /opt/cola/permits/1258059374\_1643027386.0/0/offheap-store-2-4-3-sources-

```

jar/org/terracotta/offheapstore/storage/portability/BooleanPortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/Metadata.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/WriteLockedOffHeapClockCache.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/storage/portability/PersistentSerializablePortability.java
*
/opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentOffHeapCache.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/listener/RecoveryStorageEngineListener.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/storage/Region.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/ByteBufferInputStream.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentHalfStorageEngine.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/storage/portability/PersistentByteArrayPortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/Factory.java
*
/opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapHashMap.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/listener/StorageEngineListener.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/paging/MappedPage.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/buffersource/BufferSource.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/NoOpLock.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/portability/WriteContext.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/portability/WriteBackPortability.java
*
/opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/portability/StringPortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentLockedOffHeapHashMap.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/listener/ListenableStorageEngine.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/MapInternals.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapClockCache.java

```

```
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/paging/UnlimitedPageSource.java
*
/opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/allocator/IntegerBestFitAllocator.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/MemoryUnit.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/ReadWriteLockedOffHeapClockCache.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentConcurrentOffHeapMap.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/allocator/Region.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/ConcurrentMapInternals.java
```

## 1.258 nio-stream-storage 1.1.3

### 1.258.1 Available under license :

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```

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```
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/StreamStorageFactory.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/DeferredFileStreamStorageFactory.java
*
/opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/Disposable.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/FileStreamStorage.java
```

```
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/StreamStorage.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-
jar/org/synchronoss/cloud/nio/stream/storage/NameAwarePurgableFileInputStream.java
```

## 1.259 junixsocket-common 2.3.2

### 1.259.1 Available under license :

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```

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```
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocket.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/Closeables.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/SuppressFBWarnings.java
*
/opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/NativeUnixSocket.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketImpl.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketCapability.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketFactory.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXServerSocket.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
```

```
jar/org/newsclub/net/unix/NativeLibraryLoader.java
* /opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketAddress.java
*
/opt/cola/permits/1258507885_1643078430.71/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketCredentials.java
```

## 1.260 junixsocket-native-common 2.3.2

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 */
```

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```
* /opt/cola/permits/1258508010_1643078805.99/0/junixsocket-native-common-2-3-2-sources-
jar/org/newsclub/lib/junixsocket/common/NarMetadata.java
```

## 1.261 webjars-locator-core 0.45

### 1.261.1 Available under license :

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## 1.262 jackson-databind-nullable 0.2.1

### 1.262.1 Available under license :

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# 1.263 jansi 1.18

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Found in path(s):

```
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/Ansi.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiConsole.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/AnsiOutputStream.java
*
 /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiRenderer.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/WindowsAnsiOutputStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiString.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/HtmlAnsiOutputStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiMain.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/FilterPrintStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiRenderWriter.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/AnsiPrintStream.java
* /opt/cola/permits/1260753865_1643213056.2/0/jansi-1-18-sources-
jar/org/fusesource/jansi/WindowsAnsiPrintStream.java
```

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Found in path(s):

\* /opt/cola/permits/1260753865\_1643213056.2/0/jansi-1-18-sources-jar/org/fusesource/jansi/WindowsSupport.java

## 1.264 netty-transport 4.1.51.Final

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Found in path(s):

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelHandlerMask.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/EventLoopTaskQueueFactory.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ExtendedClosedChannelException.java

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Found in path(s):

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/DefaultChannelHandlerContext.java

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Found in path(s):

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/nio/NioSocketChannel.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ThreadPerChannelEventLoopGroup.java

\*

/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/bootstrap/package-info.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/VoidChannelPromise.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/nio/NioEventLoopGroup.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/nio/AbstractNioMessageChannel.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-

jar/io/netty/channel/group/package-info.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/ServerSocketChannelConfig.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/embedded/package-info.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ServerChannel.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelInitializer.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/InternetProtocolFamily.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/oio/OioDatagramChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/bootstrap/ServerBootstrap.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/EventLoopGroup.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/DefaultEventLoop.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelConfig.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/package-info.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/SocketChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/AbstractServerChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/nio/package-info.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/AdaptiveRecvByteBufAllocator.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/AbstractChannelHandlerContext.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/local/package-info.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/SingleThreadEventLoop.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/oio/AbstractOioMessageChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/SucceededChannelFuture.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/local/LocalChannelRegistry.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/oio/OioServerSocketChannel.java

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* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/local/LocalChannel.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelPipeline.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/nio/NioEventLoop.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/oio/OioSocketChannel.java
*
/opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/AbstractChannel.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/local/LocalEventLoopGroup.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultFileRegion.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/CombinedChannelDuplexHandler.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelPromise.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/DefaultServerSocketChannelConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/nio/NioDatagramChannel.java
*
/opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/SocketChannelConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/oio/AbstractOioChannel.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/nio/ProtocolFamilyConverter.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelFlushPromiseNotifier.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/nio/AbstractNioChannel.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelFuture.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/nio/AbstractNioByteChannel.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultEventLoopGroup.java
*
/opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/MultithreadEventLoopGroup.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/oio/package-info.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/bootstrap/AbstractBootstrap.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-

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jar/io/netty/channel/ChannelMetadata.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/DefaultChannelPromise.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelOption.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/DatagramChannel.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/FailedChannelFuture.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelDuplexHandler.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelPromiseAggregator.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelPipelineException.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/embedded/EmbeddedSocketAddress.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/Channel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelException.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/oio/AbstractOioByteChannel.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelInboundHandler.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/ServerSocketChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/DefaultChannelPipeline.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/embedded/EmbeddedEventLoop.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelHandlerContext.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/RecvByteBufAllocator.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelPromiseNotifier.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ThreadPerChannelEventLoop.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/group/CombinedIterator.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/nio/NioDatagramChannelConfig.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ChannelOutboundHandler.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/DefaultChannelGroupFuture.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/FixedRecvByteBufAllocator.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/CompleteChannelFuture.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalAddress.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/package-info.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/NioServerSocketChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelFutureListener.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DefaultSocketChannelConfig.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ChannelInputShutdownEvent.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelConfig.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DefaultDatagramChannelConfig.java  
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/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/package-info.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupFuture.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundHandlerAdapter.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/FileRegion.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/EventLoopException.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DatagramChannelConfig.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/Bootstrap.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupFutureListener.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalServerChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/oio/OioEventLoopGroup.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DatagramPacket.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-

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jar/io/netty/channel/socket/oio/package-info.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelInboundHandlerAdapter.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/nio/NioTask.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/EventLoop.java
*
/opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/embedded/EmbeddedChannel.java
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```

Found in path(s):

```
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/WriteBufferWaterMark.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelInboundInvoker.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/group/VoidChannelGroupFuture.java
*
/opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/bootstrap/ServerBootstrapConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/bootstrap/AbstractBootstrapConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/bootstrap/BootstrapConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelOutboundInvoker.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultSelectStrategy.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultSelectStrategyFactory.java
```

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DuplexChannel.java

\*

/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SelectStrategyFactory.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SelectStrategy.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/PreferHeapByteBufAllocator.java

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\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/NioChannelOption.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SimpleUserEventChannelHandler.java

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```

*/
/**
 * Handles an I/O event or intercepts an I/O operation, and forwards it to its next handler in
 * its { @link ChannelPipeline }.
 *
 * <h3>Sub-types</h3>
 * <p>
 * { @link ChannelHandler } itself does not provide many methods, but you usually have to implement one of its
 * subtypes:
 *
 * { @link
 * ChannelInboundHandler } to handle inbound I/O events, and
 * { @link ChannelOutboundHandler } to handle outbound I/O operations.
 *
 * </p>
 * <p>
 * Alternatively, the following adapter classes are provided for your convenience:
 *
 * { @link ChannelInboundHandlerAdapter } to handle inbound I/O events,
 * { @link ChannelOutboundHandlerAdapter } to handle outbound I/O operations, and
 * { @link ChannelDuplexHandler } to handle both inbound and outbound events
 *
 * </p>
 * <p>
 * For more information, please refer to the documentation of each subtype.
 * </p>
 *
 * <h3>The context object</h3>
 * <p>
 * A { @link ChannelHandler } is provided with a { @link ChannelHandlerContext }
 * object. A { @link ChannelHandler } is supposed to interact with the
 * { @link ChannelPipeline } it belongs to via a context object. Using the
 * context object, the { @link ChannelHandler } can pass events upstream or
 * downstream, modify the pipeline dynamically,
 * or store the information
 * (using { @link AttributeKey }s) which is specific to the handler.
 *
 * <h3>State management</h3>
 *
 * A { @link ChannelHandler } often needs to store some stateful information.
 * The simplest and recommended approach is to use member variables:
 * <pre>
 * public interface Message {
 * // your methods here
 * }
 *
 * public class DataServerHandler extends { @link SimpleChannelInboundHandler }<Message> {
 *

```



```

* private boolean loggedIn;
*
* { @code @Override }
* public void channelRead0({ @link ChannelHandlerContext } ctx, Message message) {
* if (message instanceof LoginMessage) {
* authenticate((LoginMessage) message);
* loggedIn = true;
* } else (message instanceof GetDataMessage) {
* if (loggedIn) {
* ctx.writeAndFlush(fetchSecret((GetDataMessage) message));
* } else {
* fail();
* }
* }
* }
* ...
* }
* </pre>

```

\* Because the handler instance has a state variable which is dedicated to
 \* one connection, you have to create a new handler instance for each new
 \* channel to avoid a race condition where a unauthenticated client can get
 \* the confidential information:

```

* <pre>
* // Create a new handler instance per channel.
* // See { @link ChannelInitializer#initChannel(Channel)}.
* public class DataServerInitializer extends { @link ChannelInitializer}<{ @link Channel}> {
* { @code @Override }
* public void initChannel({ @link Channel } channel) {
* channel.pipeline().addLast("handler", new DataServerHandler());
* }
* }
*
* </pre>

```

\* <h4>Using { @link AttributeKey}s</h4>

\* Although it's recommended to use member variables to store the state of a
 \* handler, for some reason you might not want to create many handler instances.
 \* In such a case, you can use { @link AttributeKey}s which is provided by
 \* { @link ChannelHandlerContext}:

```

* <pre>
* public interface Message {
* // your methods here
* }
*
* { @code @Sharable }
* public class DataServerHandler extends { @link SimpleChannelInboundHandler}<Message> {
* private final { @link AttributeKey}<{ @link Boolean}>; auth =

```

```

* {@link AttributeKey#valueOf(String) AttributeKey.valueOf("auth")});
*
* {@code @Override}
* public void channelRead({@link ChannelHandlerContext} ctx, Message message) {
* {@link Attribute}<{@link Boolean}> attr = ctx.attr(auth);
* if (message instanceof LoginMessage) {
* authenticate((LoginMessage) o);
* attr.set(true);
* } else (message instanceof GetDataMessage) {
* if (Boolean.TRUE.equals(attr.get())) {
* ctx.writeAndFlush(fetchSecret((GetDataMessage) o));
* } else {
* fail();
* }
* }
* }
* }
* ...
* }
* </pre>

```

\* Now that the state of the handler is attached to the {@link ChannelHandlerContext}, you can add the same handler instance to different pipelines:

```

* <pre>
* public class DataServerInitializer extends {@link ChannelInitializer}<{@link Channel}> {
*
* private static final DataServerHandler SHARED = new DataServerHandler();
*
* {@code @Override}
* public void initChannel({@link Channel} channel) {
* channel.pipeline().addLast("handler", SHARED);
* }
* }
* </pre>

```

\* <h4>The {@code @Sharable} annotation</h4>

\* <p>In the example above which used an {@link AttributeKey}, you might have noticed the {@code @Sharable} annotation.

\* <p>If a {@link ChannelHandler} is annotated with the {@code @Sharable} annotation, it means you can create an instance of the handler just once and add it to one or more {@link ChannelPipeline}s multiple times without a race condition.

\* <p>If this annotation is not specified, you have to create a new handler instance every time you add it to a pipeline because it has unshared state

\* such as member variables.  
\* <p>  
\* This annotation is provided for documentation purpose, just like  
\* <a href="http://www.javaconcurrencyinpractice.com/annotations/doc/">the JCIP annotations</a>.  
\*  
\* <h3>Additional resources worth reading</h3>  
\* <p>  
\* Please refer to the { @link ChannelHandler}, and  
\* { @link ChannelPipeline} to find out more about inbound and outbound operations,  
\* what fundamental differences they have, how they flow in a pipeline, and how to handle  
\* the operation in your application.  
\*/

Found in path(s):

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelHandler.java

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\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/ChannelPoolHandler.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/FixedChannelPool.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/MaxBytesRecvByteBufAllocator.java

\*

/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/MaxMessagesRecvByteBufAllocator.java

\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultMaxMessagesRecvByteBufAllocator.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultMaxBytesRecvByteBufAllocator.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/ChannelPoolMap.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/package-info.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/ChannelPool.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/SimpleChannelPool.java  
\*

/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/ChannelHealthChecker.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/AbstractChannelPoolHandler.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/AbstractChannelPoolMap.java

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\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/ChannelOutputShutdownException.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/internal/package-info.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/internal/ChannelUtils.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/DelegatingChannelPromiseNotifier.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/ChannelOutputShutdownEvent.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/ChannelInputShutdownReadComplete.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/nio/SelectedSelectionKeySetSelector.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/bootstrap/FailedChannel.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/PendingBytesTracker.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/socket/oio/DefaultOioDatagramChannelConfig.java  
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/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
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- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ConnectTimeoutException.java
- \*
- /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/AddressedEnvelope.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/SelectedSelectionKeySet.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultAddressedEnvelope.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SimpleChannelInboundHandler.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressiveFutureListener.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelHandlerAdapter.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundBuffer.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupException.java
- \*
- /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/DefaultChannelGroup.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractEventLoopGroup.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelMatchers.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelMatcher.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressivePromise.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressiveFuture.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelId.java
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- /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroup.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelProgressivePromise.java
- \* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-

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jar/io/netty/channel/socket/oio/DefaultOioSocketChannelConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/oio/DefaultOioServerSocketChannelConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultChannelId.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/oio/OioSocketChannelConfig.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultMessageSizeEstimator.java
*
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/MessageSizeEstimator.java
* /opt/cola/permits/1260753206_1643213349.03/0/netty-transport-4-1-51-final-sources-
jar/io/netty/bootstrap/ChannelFactory.java
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jar/io/netty/channel/ChannelFactory.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/AbstractEventLoop.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/ReflectiveChannelFactory.java  
\*  
/opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/embedded/EmbeddedChannelId.java  
\* /opt/cola/permits/1260753206\_1643213349.03/0/netty-transport-4-1-51-final-sources-  
jar/io/netty/channel/PendingWriteQueue.java

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jar/io/netty/handler/codec/DatagramPacketDecoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-  
jar/io/netty/handler/codec/string/LineSeparator.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-  
jar/io/netty/handler/codec/DatagramPacketEncoder.java  
\*

/opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/CompressionUtil.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/string/LineEncoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DateFormatter.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/CodecOutputList.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ByteBufChecksum.java  
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufEncoderNano.java  
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/opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ProtocolDetectionResult.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufEncoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/UnsupportedValueConverter.java  
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufVarint32FrameDecoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufDecoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufDecoderNano.java

\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/HeadersUtils.java

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* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/FixedLengthFrameDecoder.java
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/opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/SnappyFrameDecoder.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/marshalling/MarshallingDecoder.java
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jar/io/netty/handler/codec/xml/package-info.java
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jar/io/netty/handler/codec/CorruptedFrameException.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
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jar/io/netty/handler/codec/marshalling/ContextBoundUnmarshallerProvider.java
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* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
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jar/io/netty/handler/codec/serialization/ObjectDecoderInputStream.java  
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jar/io/netty/handler/codec/marshalling/ThreadLocalUnmarshallerProvider.java  
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jar/io/netty/handler/codec/compression/package-info.java

\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ReplayingDecoderByteBuf.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/MessageToMessageCodec.java  
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ClassLoaderClassResolver.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ZlibEncoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DecoderResult.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/ChannelBufferByteInput.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ReplayingDecoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/UnmarshallerProvider.java  
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/SoftReferenceMap.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/CodecException.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/CompatibleMarshallingEncoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DelimiterBasedFrameDecoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/DecompressionException.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/base64/Base64Decoder.java  
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/JdkZlibEncoder.java  
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jar/io/netty/handler/codec/string/StringDecoder.java
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* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
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* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
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* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Bzip2Encoder.java  
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Bzip2DivSufSort.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/SnappyFramedDecoder.java  
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\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Crc32.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/LzfDecoder.java  
\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-



```
jar/io/netty/handler/codec/compression/LzfEncoder.java
*
/opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/Bzip2HuffmanStageEncoder.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/json/JsonObjectDecoder.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/DecoderResultProvider.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/SnappyFramedEncoder.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/Bzip2MoveToFrontTable.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/Bzip2BlockCompressor.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/FastLz.java
*
/opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/Bzip2MTFAndRLE2StageEncoder.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/Bzip2HuffmanStageDecoder.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/json/package-info.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/Bzip2BitWriter.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/MessageAggregationException.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/LzmaFrameEncoder.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/FastLzFrameDecoder.java
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*/
```

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 * http://creativecommons.org/licenses/publicdomain
 */
/**
 * Utility class for { @link ByteBuf } that encodes and decodes to and from
 * Base64 notation.
 *

*
 * The encoding and decoding algorithm in this class has been derived from
 * Robert Harder's Public Domain
 * Base64 Encoder/Decoder.
 */


```

Found in path(s):

```
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codecs/base64/Base64.java
```

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```

Found in path(s):

```
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codecs/EmptyHeaders.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codecs/Headers.java
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codecs/DefaultHeaders.java
```

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*/
/*
* Written by Robert Harder and released to the public domain, as explained at
* http://creativecommons.org/licenses/publicdomain
*/
/**
* Enumeration of supported Base64 dialects.
* <p>
* The internal lookup tables in this class has been derived from
* Robert
 Harder's Public Domain
* Base64 Encoder/Decoder.
*/
```

Found in path(s):

```
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/base64/Base64Dialect.java
```

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```

Found in path(s):

```
* /opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/xml/XmlFrameDecoder.java
```

\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Crc32c.java

\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/JdkZlibDecoder.java

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Found in path(s):

\* /opt/cola/permits/1260753723\_1643213345.57/0/netty-codec-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-codec/pom.xml

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/\*\*

\* A decoder that splits the received {@link ByteBuf}s dynamically by the  
\* value of the length field in the message. It is particularly useful when you  
\* decode a binary message which has an integer header field that represents the  
\* length of the message body or the whole message.

\*

<p>

\* { @link LengthFieldBasedFrameDecoder } has many configuration parameters so  
\* that it can decode any message with a length field, which is often seen in  
\* proprietary client-server protocols. Here are some example that will give  
\* you the basic idea on which option does what.

\*

\* <h3>2 bytes length field at offset 0, do not strip header</h3>

\*

\* The value of the length field in this example is <tt>12 (0x0C)</tt> which  
\* represents the length of "HELLO, WORLD". By default, the decoder assumes  
\* that the length field represents the number of the bytes that follows the  
\* length field. Therefore, it can be decoded with the simplistic parameter  
\* combination.

\* <pre>

```
* lengthFieldOffset = 0
* lengthFieldLength = 2
* lengthAdjustment = 0
* initialBytesToStrip = 0 (= do not strip header)
```

\*

\* BEFORE DECODE (14 bytes)      AFTER DECODE (14 bytes)

```
* +-----+-----+ +-----+-----+
* | Length | Actual Content
* |---->| Length | Actual Content |
* | 0x000C | "HELLO, WORLD" | | 0x000C | "HELLO, WORLD" |
* +-----+-----+ +-----+-----+
```

\* </pre>

\*

\* <h3>2 bytes length field at offset 0, strip header</h3>

\*

\* Because we can get the length of the content by calling  
\* { @link ByteBuf#readableBytes() }, you might want to strip the length  
\* field by specifying <tt>initialBytesToStrip</tt>. In this example, we  
\* specified <tt>2</tt>, that is same with the length of the length field, to  
\* strip the first two bytes.

\* <pre>

```
* lengthFieldOffset = 0
* lengthFieldLength = 2
* lengthAdjustment = 0
* initialBytesToStrip = 2 (= the length of the Length field)
```

\*

\* BEFORE DECODE (14 bytes)      AFTER DECODE (12 bytes)

```
* +-----+-----+ +-----+
* | Length | Actual Content |---->| Actual Content |
* | 0x000C | "HELLO, WORLD" | | "HELLO, WORLD" |
* +-----+-----+ +-----+
```

\* </pre>

\*

\* <h3>2 bytes length field at offset 0, do not strip header, the length field

- \* represents the length of the whole message
- \* In most cases, the length field represents the length of the message body only, as shown in the previous examples. However, in some protocols, the length field represents the length of the whole message, including the message header. In such a case, we specify a non-zero `lengthAdjustment`. Because the length value in this example message is always greater than the body length by 2, we specify `-2` as `lengthAdjustment` for compensation.

```

* <pre>
* lengthFieldOffset = 0
* lengthFieldLength = 2
* lengthAdjustment = -2 (= the length of the Length field)
* initialBytesToStrip = 0

```

```

* BEFORE DECODE (14 bytes) AFTER DECODE (14 bytes)
* +-----+-----+-----+-----+
* | Length | Actual Content |---->| Length | Actual
 Content |
* | 0x000E | "HELLO, WORLD" | | 0x000E | "HELLO, WORLD" |
* +-----+-----+-----+-----+
* </pre>

```

3 bytes length field at the end of 5 bytes header, do not strip header

- \* The following message is a simple variation of the first example. An extra header value is prepended to the message. `lengthAdjustment` is zero again because the decoder always takes the length of the prepended data into account during frame length calculation.

```

* <pre>
* lengthFieldOffset = 2 (= the length of Header 1)
* lengthFieldLength = 3
* lengthAdjustment = 0
* initialBytesToStrip = 0
*
* BEFORE DECODE (17 bytes) AFTER DECODE (17 bytes)
* +-----+-----+-----+-----+
* | Header 1 | Length | Actual Content |---->| Header 1 | Length | Actual Content |
* | 0xCAFE | 0x00000C | "HELLO, WORLD" | |
 0xCAFE | 0x00000C | "HELLO, WORLD" |
* +-----+-----+-----+-----+
* </pre>

```

3 bytes length field at the beginning of 5 bytes header, do not strip header

- \* This is an advanced example that shows the case where there is an extra header between the length field and the message body. You have to specify a positive `lengthAdjustment` so that the decoder counts the extra

```

* header into the frame length calculation.
* <pre>
* lengthFieldOffset = 0
* lengthFieldLength = 3
* lengthAdjustment = 2 (= the length of Header 1)
* initialBytesToStrip = 0
*
* BEFORE DECODE (17 bytes) AFTER DECODE (17 bytes)
* +-----+-----+-----+-----+ +-----+-----+-----+-----+
* | Length | Header 1 | Actual Content |----->| Length | Header 1 | Actual Content |
* | 0x00000C | 0xCAFE | "HELLO, WORLD" | | 0x00000C | 0xCAFE | "HELLO,
* WORLD" |
* +-----+-----+-----+-----+ +-----+-----+-----+-----+
* </pre>
*
* <h3>2 bytes length field at offset 1 in the middle of 4 bytes header,
* strip the first header field and the length field</h3>
*
* This is a combination of all the examples above. There are the prepended
* header before the length field and the extra header after the length field.
* The prepended header affects the <tt>lengthFieldOffset</tt> and the extra
* header affects the <tt>lengthAdjustment</tt>. We also specified a non-zero
* <tt>initialBytesToStrip</tt> to strip the length field and the prepended
* header from the frame. If you don't want to strip the prepended header, you
* could specify <tt>0</tt> for <tt>initialBytesToSkip</tt>.
* <pre>
* lengthFieldOffset = 1 (= the length of HDR1)
* lengthFieldLength = 2
* lengthAdjustment = 1 (= the length of HDR2)
* initialBytesToStrip = 3 (= the length of HDR1 + LEN)
*
* BEFORE DECODE (16 bytes) AFTER DECODE (13 bytes)
* +-----+-----+-----+-----+ +-----+-----+-----+-----+
* | HDR1 | Length | HDR2 | Actual Content |----->| HDR2 | Actual Content |
* | 0xCA | 0x000C | 0xFE | "HELLO, WORLD" | | 0xFE | "HELLO, WORLD" |
* +-----+-----+-----+-----+ +-----+-----+-----+-----+
* </pre>
*
* <h3>2 bytes length field at offset 1 in the middle of 4 bytes header,
* strip the first header field and the length field, the length field
* represents the length of the whole message</h3>
*
* Let's give another twist to the previous example. The only difference from
* the previous example is that the length field represents the length of the
* whole message instead of the message body, just like the third example.
* We have to count the length of HDR1 and Length into <tt>lengthAdjustment</tt>.
* Please note that we don't need to take the length of HDR2 into account
* because

```

the length field already includes the whole header length.

```
* <pre>
* lengthFieldOffset = 1
* lengthFieldLength = 2
* lengthAdjustment = -3 (= the length of HDR1 + LEN, negative)
* initialBytesToStrip = 3
*
* BEFORE DECODE (16 bytes) AFTER DECODE (13 bytes)
* +-----+-----+-----+-----+ +-----+-----+
* | HDR1 | Length | HDR2 | Actual Content |----->| HDR2 | Actual Content |
* | 0xCA | 0x0010 | 0xFE | "HELLO, WORLD" | | 0xFE | "HELLO, WORLD" |
* +-----+-----+-----+-----+ +-----+-----+
* </pre>
* @see LengthFieldPrepender
*/
```

Found in path(s):

```
*/opt/cola/permits/1260753723_1643213345.57/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/LengthFieldBasedFrameDecoder.java
```

## 1.266 netty-handler 4.1.51.Final

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```
*/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/address/ResolveAddressHandler.java
*/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/SslHandshakeTimeoutException.java
*
```



/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/ByteBufFormat.java

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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemPrivateKey.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslCertificateException.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslContext.java

\*

/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslServerContext.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/flow/package-info.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/X509TrustManagerWrapper.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslEngine.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/flush/package-info.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Java8SslUtils.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemValue.java

\*

/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/DelegatingSslContext.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/flush/FlushConsolidationHandler.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-

```
jar/io/netty/handler/ssl/PemEncoded.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/ReferenceCountedOpenSslClientContext.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslKeyMaterialManager.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
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image/io.netty.handler.native-image.properties
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* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/stream/ChunkedInput.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/timeout/ReadTimeoutHandler.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/timeout/ReadTimeoutException.java
*
/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/SslHandler.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/timeout/IdleStateEvent.java
```

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedWriteHandler.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/WriteTimeoutException.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/package-info.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/IdleState.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/package-info.java  
\*

/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedNioStream.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedNioFile.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/package-info.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/package-info.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/TimeoutException.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedFile.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/IdleStateHandler.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/LogLevel.java  
\*

/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedStream.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/WriteTimeoutHandler.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/NotSslRecordException.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/LoggingHandler.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/package-info.java

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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-  
jar/io/netty/handler/traffic/AbstractTrafficShapingHandler.java  
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jar/io/netty/handler/traffic/package-info.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-  
jar/io/netty/handler/traffic/GlobalTrafficShapingHandler.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-  
jar/io/netty/handler/traffic/ChannelTrafficShapingHandler.java  
\*  
/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-  
jar/io/netty/handler/traffic/TrafficCounter.java  
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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslContextBuilder.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNegotiationHandler.java  
\*  
/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionTicketKey.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ClientAuth.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNames.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolAccessor.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslJavaxX509Certificate.java  
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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkApplicationProtocolNegotiator.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JettyNpnSslEngine.java  
\*  
/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509Certificate.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnApplicationProtocolNegotiator.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JettyAlpnSslEngine.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SniHandler.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/CipherSuiteFilter.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/ThreadLocalInsecureRandom.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslContext.java  
\*  
/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolUtil.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/package-info.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkNpnApplicationProtocolNegotiator.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslUtils.java  
\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslEngine.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpSubnetFilterRule.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslServerSessionContext.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/AbstractRemoteAddressFilter.java

\*

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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolConfig.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionContext.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Java7SslParametersUtils.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslClientContext.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/FingerprintTrustManagerFactory.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslServerContext.java

\*

/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/CipherSuiteConverter.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/SimpleTrustManagerFactory.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslNpnApplicationProtocolNegotiator.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/RuleBasedIpFilter.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSsl.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslProvider.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/OpenJdkSelfSignedCertGenerator.java

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/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkDefaultApplicationProtocolNegotiator.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslEngineMap.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNegotiator.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpFilterRuleType.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/BouncyCastleSelfSignedCertGenerator.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-

```
jar/io/netty/handler/ssl/SslContext.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/JdkSslServerContext.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/JdkSslContext.java
*
/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslSessionStats.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/JdkBaseApplicationProtocolNegotiator.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ipfilter/IpFilterRule.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslDefaultApplicationProtocolNegotiator.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslApplicationProtocolNegotiator.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/PemReader.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslClientContext.java
*
/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/IdentityCipherSuiteFilter.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/util/InsecureTrustManagerFactory.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/SupportedCipherSuiteFilter.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ipfilter/UniqueIpFilter.java
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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ocsp/OcspClientHandler.java

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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslClientHelloHandler.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Conscrypt.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnSslUtils.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OptionalSslHandler.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ocsp/package-info.java

\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnSslEngine.java

\*

/opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ConscryptAlpnSslEngine.java

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jar/io/netty/handler/ssl/SslMasterKeyHandler.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/address/DynamicAddressConnectHandler.java
*
/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/address/package-info.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/TrustManagerFactoryWrapper.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslPrivateKeyMethod.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/util/SimpleKeyManagerFactory.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/KeyManagerFactoryWrapper.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/PseudoRandomFunction.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/util/X509KeyManagerWrapper.java
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jar/io/netty/handler/ssl/util/SelfSignedCertificate.java
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* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/DefaultOpenSslKeyMaterial.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslX509TrustManagerWrapper.java
*
/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslX509KeyManagerFactory.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslKeyMaterialProvider.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslPrivateKey.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslCachingKeyMaterialProvider.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslCachingX509KeyManagerFactory.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslKeyMaterial.java
```

```
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/ExtendedOpenSslSession.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslTlsv13X509ExtendedTrustManager.java
*
/opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/SignatureAlgorithmConverter.java
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/OpenSslSession.java
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Found in path(s):

```
* /opt/cola/permits/1260753132_1643213170.3/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/flow/FlowControlHandler.java
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\* /opt/cola/permits/1260753132\_1643213170.3/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/GlobalChannelTrafficShapingHandler.java

# 1.267 netty-resolver 4.1.51.Final

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Found in path(s):

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-resolver/pom.xml

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Found in path(s):

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-

jar/io/netty/resolver/RoundRobinInetAddressResolver.java

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\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NoopAddressResolverGroup.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NoopAddressResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NameResolver.java

\*

/opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/package-info.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AddressResolverGroup.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/SimpleNameResolver.java

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\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultAddressResolverGroup.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AbstractAddressResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/CompositeNameResolver.java

\*

/opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultHostsFileEntriesResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/InetNameResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileEntriesResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultNameResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/InetSocketAddressResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AddressResolver.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileParser.java

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\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/ResolvedAddressTypes.java

\* /opt/cola/permits/1260753342\_1643213326.89/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileEntries.java

# 1.268 byte-buddy 1.10.14

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# 1.269 netty-transport-native-epoll 4.1.51.Final

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 */
/**
 * Set the {@code TCP_MD5SIG} option on the socket. See {@code linux/tcp.h} for more details.
 * Keys can only be set on, not read to prevent a potential leak, as they are confidential.
 * Allowing them being read would mean anyone with access to the channel could get them.
 */
```

Found in path(s):

```
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/EpollServerSocketChannelConfig.java
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\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/TcpMd5Util.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollServerDomainSocketChannel.java  
\*  
/opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDomainSocketChannelConfig.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollMode.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventArray.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollServerChannelConfig.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/AbstractEpollServerChannel.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollRecvByteAllocatorStreamingHandle.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/AbstractEpollStreamChannel.java  
\*  
/opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDomainSocketChannel.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollRecvByteAllocatorHandle.java  
\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollChannelConfig.java  
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\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/netty\_epoll\_native.c

\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/Native.java

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\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/package-info.java

\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollChannelOption.java

\*

/opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollSocketChannel.java

\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDatagramChannel.java

\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/NativeDatagramPacketArray.java

\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-

```
jar/io/netty/channel/epoll/EpollTcpInfo.java
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/AbstractEpollChannel.java
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/EpollEventLoop.java
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/EpollEventLoopGroup.java
*
/opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/EpollServerSocketChannel.java
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
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Found in path(s):
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/NativeStaticallyReferencedJniMethods.java
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/LinuxSocket.java
*
/opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/netty_epoll_linuxsocket.h
* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/netty_epoll_linuxsocket.c
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Found in path(s):

\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-transport-native-epoll/pom.xml

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Found in path(s):

\* /opt/cola/permits/1262374744\_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io.netty/channel/epoll/EpollDatagramChannelConfig.java

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```

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*/
/**
 * Set the {@code TCP_MD5SIG} option on the socket. See {@code linux/tcp.h} for more details.
 * Keys can only be set on, not read to prevent a potential leak, as they are confidential.
 * Allowing them being read would mean anyone with access to the channel could get them.

*/
/**
 * Set the {@code TCP_QUICKACK} option on the socket. See TCP_QUICKACK
 * for more details.
*/

```

Found in path(s):

```

* /opt/cola/permits/1262374744_1643394735.77/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/EpollSocketChannelConfig.java

```

## 1.270 netty-codec-socks 4.1.51.Final

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* /opt/cola/permits/1262374766_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/META-
INF/maven/io.netty/netty-codec-socks/pom.xml

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Found in path(s):

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/UnknownSocksRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/SocksMessage.java  
\*  
/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4ServerDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitResponseDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/package-info.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandResponse.java  
\*  
/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdRequestDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5InitialRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandType.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/DefaultSocks4CommandRequest.java  
\*

/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitRequestDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/package-info.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthResponseDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/UnknownSocksResponse.java  
\*  
/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5CommandRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthRequestDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandStatus.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/DefaultSocks4CommandResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5InitialResponse.java  
\*  
/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksMessageEncoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksMessage.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCommonUtils.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthRequest.java  
\*  
/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitRequest.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-

jar/io/netty/handler/codec/socksx/v4/Socks4ClientDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-  
jar/io/netty/handler/codec/socks/SocksCmdResponseDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-  
jar/io/netty/handler/codec/socksx/v5/DefaultSocks5CommandResponse.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-  
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jar/io/netty/handler/codec/socksx/v5/Socks5AddressDecoder.java  
\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-  
jar/io/netty/handler/codec/socksx/SocksPortUnificationServerHandler.java  
\*  
/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-  
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\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4Message.java

\*

/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5Message.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthResponseDecoder.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5ClientEncoder.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/package-info.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/AbstractSocks4Message.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/AbstractSocksMessage.java

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/opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandRequestDecoder.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandResponseDecoder.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialResponseDecoder.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5ServerEncoder.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/AbstractSocks5Message.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthRequestDecoder.java

\* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4ServerEncoder.java

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- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5AuthMethod.java
- \*
- /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthStatus.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthScheme.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthStatus.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAddressType.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksProtocolVersion.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5AddressType.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksMessageType.java
- \*
- /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdStatus.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandStatus.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksSubnegotiationVersion.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdType.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandType.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksResponseType.java
- \* /opt/cola/permits/1262374766\_1643394685.05/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksRequestType.java

# 1.271 netty-transport-native-unix-common

## 4.1.51.Final

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\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io.netty/channel/unix/UnixChannelOption.java

\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-

jar/io/netty/channel/unix/package-info.java

\*

/opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-

jar/io/netty/channel/unix/IovArray.java

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\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_buffer.c

\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/PreferredDirectByteBufAllocator.java

\*

/opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Buffer.java

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\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/ErrorsStaticallyReferencedJniMethods.java  
\*  
/opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_util.h  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_limits.h  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_util.c  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_limits.c  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/PeerCredentials.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Limits.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/SocketWritableByteChannel.java  
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\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/UnixChannelUtil.java  
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\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DatagramSocketAddress.java  
\*  
/opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketAddress.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/NativeInetAddress.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Socket.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/UnixChannel.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_filedescriptor.c  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Errors.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_socket.c  
\*  
/opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_errors.c  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketReadMode.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty\_unix\_socket.h  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketChannel.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/ServerDomainSocketChannel.java  
\* /opt/cola/permits/1262374734\_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/FileDescriptor.java

```
* /opt/cola/permits/1262374734_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-
jar/netty_unix_errors.h
*
/opt/cola/permits/1262374734_1643394695.34/0/netty-transport-native-unix-common-4-1-51-final-sources-
jar/io/netty/channel/unix/DomainSocketChannelConfig.java
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## 1.272 netty-handler-proxy 4.1.51.Final

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* /opt/cola/permits/1262374813_1643394744.24/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/package-info.java
* /opt/cola/permits/1262374813_1643394744.24/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/ProxyConnectException.java
*
/opt/cola/permits/1262374813_1643394744.24/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/Socks4ProxyHandler.java
* /opt/cola/permits/1262374813_1643394744.24/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/HttpProxyHandler.java
* /opt/cola/permits/1262374813_1643394744.24/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/Socks5ProxyHandler.java
* /opt/cola/permits/1262374813_1643394744.24/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/ProxyConnectionEvent.java
* /opt/cola/permits/1262374813_1643394744.24/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/ProxyHandler.java
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## 1.273 netty-codec-http 4.1.51.Final

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\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/AbstractHttp2ConnectionHandlerBuilder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/HttpToHttp2ConnectionHandlerBuilder.java  
\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/CharSequenceMap.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-

jar/io/netty/handler/codec/http2/Http2ConnectionHandlerBuilder.java

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jar/io/netty/handler/codec/http2/HpackEncoder.java

\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-

jar/io/netty/handler/codec/http2/HpackHuffmanDecoder.java

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jar/io/netty/handler/codec/http2/HpackStaticTable.java

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jar/io/netty/handler/codec/http2/HpackHeaderField.java

\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-

jar/io/netty/handler/codec/http2/HpackDynamicTable.java

\*

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/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/HpackUtil.java
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jar/io/netty/handler/codec/http2/HpackDecoder.java
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jar/io/netty/handler/codec/http2/HpackHuffmanEncoder.java
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jar/io/netty/handler/codec/http2/Http2EmptyDataFrameListener.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2ControlFrameLimitEncoder.java
*
/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2EmptyDataFrameConnectionDecoder.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2SettingsReceivedConsumer.java
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jar/io/netty/handler/codec/http2/DefaultHttp2SettingsAckFrame.java  
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jar/io/netty/handler/codec/http2/MaxCapacityQueue.java  
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/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2MultiplexHandler.java  
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jar/io/netty/handler/codec/http2/Http2SettingsAckFrame.java  
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jar/io/netty/handler/codec/http2/AbstractHttp2StreamChannel.java

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jar/io/netty/handler/codec/http2/Http2FrameCodecBuilder.java

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jar/io/netty/handler/codec/http2/CleartextHttp2ServerUpgradeHandler.java
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/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2UnknownFrame.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DefaultHttp2UnknownFrame.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2FrameStreamEvent.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2MultiplexCodecBuilder.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2StreamChannel.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2StreamChannelBootstrap.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2StreamChannelId.java
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jar/io/netty/handler/codec/http2/DecoratingHttp2FrameWriter.java
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* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/UniformStreamByteDistributor.java
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/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2PromisedRequestVerifier.java
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```
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DecoratingHttp2ConnectionEncoder.java
```

```
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/InboundHttp2ToHttpAdapterBuilder.java
```

```
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
```



```
jar/io/netty/handler/codec/http2/StreamByteDistributor.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/AbstractInboundHttp2ToHttpAdapterBuilder.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2StreamVisitor.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DecoratingHttp2ConnectionDecoder.java
*
/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/StreamBufferingEncoder.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/WeightedFairQueueByteDistributor.java
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```
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/InboundHttpToHttp2Adapter.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2ResetFrame.java
*
/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DefaultHttp2SettingsFrame.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2Frame.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/ReadOnlyHttp2Headers.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/AbstractHttp2StreamFrame.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DefaultHttp2GoAwayFrame.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2WindowUpdateFrame.java
```

\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2PingFrame.java  
\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2FrameCodec.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2SettingsFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2HeadersFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2ResetFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2StreamFrameToHttpObjectCodec.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2FrameStreamException.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2FrameStreamVisitor.java  
\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2DataFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2StreamFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2DataFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2ChannelDuplexHandler.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2MultiplexCodec.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2GoAwayFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2WindowUpdateFrame.java  
\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2HeadersFrame.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2FrameStream.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2PingFrame.java  
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// https://tools.ietf.org/html/rfc7540#section-8.1.2.2 makes a special exception for TE
```

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```
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/HttpConversionUtil.java
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```
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/package-info.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2FrameSizePolicy.java
*
/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2FrameListenerDecorator.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DelegatingDecompressorFrameListener.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DefaultHttp2RemoteFlowController.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DefaultHttp2FrameReader.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/DefaultHttp2FrameWriter.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
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jar/io/netty/handler/codec/http2/Http2ConnectionDecoder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2Exception.java  
\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/EmptyHttp2Headers.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/HttpToHttp2ConnectionHandler.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2Error.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2RemoteFlowController.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2HeadersDecoder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2FrameReader.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2ConnectionEncoder.java  
\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/InboundHttp2ToHttpAdapter.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2FrameListener.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2LocalFlowController.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2ConnectionAdapter.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2FlowController.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2FrameTypes.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2Stream.java  
\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2Headers.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2Settings.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2EventAdapter.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/DefaultHttp2Headers.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/Http2HeadersEncoder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/DefaultHttp2HeadersEncoder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-  
jar/io/netty/handler/codec/http2/DefaultHttp2LocalFlowController.java

\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2ClientUpgradeCodec.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2ConnectionEncoder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2DataWriter.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/CompressorHttp2ConnectionEncoder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2Connection.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2NoMoreStreamIdsException.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2FrameAdapter.java

\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2LifecycleManager.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2FrameWriter.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2Connection.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2CodecUtil.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2HeadersDecoder.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2ServerUpgradeCodec.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2Flags.java

\*  
/opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/Http2ConnectionHandler.java  
\* /opt/cola/permits/1262374751\_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-jar/io/netty/handler/codec/http2/DefaultHttp2ConnectionDecoder.java

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jar/io/netty/handler/codec/http2/Http2InboundFrameLogger.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2SecurityUtil.java
*
/opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2FrameLogger.java
* /opt/cola/permits/1262374751_1643394691.61/0/netty-codec-http2-4-1-51-final-sources-
jar/io/netty/handler/codec/http2/Http2OutboundFrameLogger.java
```

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org.ehcache.jsr107.internal.Jsr107CacheConfigurationParser

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jar/org/ehcache/core/spi/time/TimeSource.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/copy/IdentityCopier.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/persistence/DefaultLocalPersistenceService.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/events/FudgingInvocationScopedEventSink.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/store/WrapperStore.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/serialization/ByteArraySerializer.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/heap/Backend.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/builders/UserManagedCacheConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/loaderwriter/writebehind/package-info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/service/DefaultSerializerConfigurationParser.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/builders/CacheManagerBuilder.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/resilience/RobustLoaderWriterResilienceStrategy.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/event/EventType.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/UserManagedCache.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/ClassInstanceConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/persistence/FileUtils.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/events/CacheEvents.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/persistence/UserManagedPersistenceContext.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/store/events/package-info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/DelegatingOperationStatistic.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/DefaultConfigurationResolver.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/CacheConfigurationChangeEvent.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/Eviction.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/store/AbstractValueHolder.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/event/EventOrdering.java

```

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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/sizeof/listeners/exceptions/VisitorListenerException.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/SingleOperation.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/config/Jsr107Configuration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/events/CacheEventDispatcherFactoryImpl.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/config/ConfigurationElementState.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/expiry/Duration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/StateTransitionException.java
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*
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/package-
info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/model/CacheTemplate.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/service/LocalPersistenceService.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/WriteAllOperation.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/time/TimeSourceService.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/BulkOps.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/events/ThreadLocalStoreEventDispatcher.java
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jar/org/ehcache/impl/config/executor/PooledExecutionServiceConfiguration.java
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jar/org/ehcache/impl/copy/ReadWriteCopier.java

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\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/serialization/package-info.java

\*

/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/model/SizeOfEngineLimits.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/collections/ConcurrentWeakIdentityHashMap.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/serialization/DoubleSerializer.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/events/StoreEventSource.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/events/CacheEventListenerConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/classes/ClassInstanceProvider.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheManager.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/CacheIterationException.java

\*

/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/TierOperationOutcomes.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107IdentityCopier.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheStatisticsMXBean.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/event/EventFiring.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/CacheConfigurationProperty.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/events/StoreEvents.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/writebehind/WriteBehindProviderConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/DefaultStatisticsService.java

\*

/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/store/StoreSupport.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheLoaderWriter.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/BatchOperation.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/DefaultTierStatistics.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheLoaderWriterProvider.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/persistence/DefaultDiskResourceService.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/config/DefaultConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/package-info.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/tiering/TieredStore.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/util/ClassLoading.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/CacheRuntimeConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/events/CacheEventDispatcherImpl.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/expiry/ExpiryPolicy.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/XmlConfiguration.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/statistics/DelegatedMappedOperationStatistics.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/sizeof/NoopSizeOfEngine.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/statistics/LowerCachingTierOperationsOutcome.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/Ehcache.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/serializer/DefaultSerializerConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/AbstractWriteBehind.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/events/AbstractStoreEventDispatcher.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/store/heap/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/store/HashUtils.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/config/store/StoreEventSourceConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/provider/DefaultCopyProviderConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/events/DisabledCacheEventNotificationService.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/SizedResourcePool.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/events/StoreEventImpl.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-

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jar/org/ehcache/jsr107/config/Js107CacheConfiguration.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/service/ServiceProvider.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/provider/CacheEventDispatcherFactoryConfigurationParser.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/events/EventListenerWrapper.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/CachingTierOperationOutcomes.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/DomUtil.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/config/store/StoreStatisticsConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/SpecIterator.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/Configuration.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/serialization/IntegerSerializer.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/expiry/package-info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/SuppliedValueStatistic.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/copy/Copier.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/ResourcePools.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/util/Pacer.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStore.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/EvictionAdvisor.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/PersistentUserManagedEhcache.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/Status.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/basic/NopStore.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/TimeSourceConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/ServiceCreationConfigurationParser.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/event/DefaultEventSourceConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/PersistentUserManagedCache.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/heap/holders/OnHeapKey.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/Eh107CompleteConfiguration.java
*

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/spi/service/PluralService.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/builders/UserManagedCacheBuilder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/jsr107/Eh107Configuration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/Builder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/copy/DefaultCopierConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/ResourceConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/HumanReadable.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/tiering/TieredStoreProviderFactory.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/BaseConfigParser.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/offheap/LazyOffHeapValueHolder.java  
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 jar/org/ehcache/config/units/MemoryUnit.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/events/FireableStoreEventHolder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/CacheManagerServiceConfigurationParser.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/BatchingLocalHeapWriteBehindQueue.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/JaxbHelper.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/loaderwriter/LocalWriteBehindLoaderWriterStore.java  
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 jar/org/ehcache/core/statistics/CacheOperationOutcomes.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/service/FileBasedPersistenceContext.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \*  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-



jar/org/ehcache/impl/internal/util/ThreadFactoryUtil.java  
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 jar/org/ehcache/core/spi/store/ConfigurationChangeSupport.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/time/package-  
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 jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterValueHolder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/config/package-  
 info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProvider.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/heap/OnHeapStoreProviderFactory.java  
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 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/service/DiskResourceService.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-

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jar/org/ehcache/jsr107/ConfigurationMerger.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/executor/OutOfBandScheduledExecutor.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/Eh107MXBean.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStoreProviderFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/store/disk/OffHeapDiskStoreConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/FluentCacheConfigurationBuilder.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/provider/OffHeapDiskStoreProviderConfigurationParser.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/CacheManager.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/service/ServiceDependencies.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/OperationObserver.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/offheap/EhcacheConcurrentOffHeapClockCache.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/serialization/UnsupportedTypeException.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/Eh107ReverseConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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*
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/CachePersistenceException.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/config/store/package-
info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/offheap/BinaryOffHeapValueHolder.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/service/DefaultCacheEventListenerConfigurationParser.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/DeleteAllOperation.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-

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jar/org/ehcache/config/builders/ExpiryPolicyBuilder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/statistics/DelegatingOperationObserver.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/service/DefaultWriteBehindConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/CoreCacheConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/loaderwriter/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/resilience/AbstractResilienceStrategy.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/statistics/StatsUtils.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/builders/package-  
 info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/model/ListenersConfig.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/time/TickingTimeSource.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/PersistentCacheManager.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/units/package-  
 info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/spi/loaderwriter/WriteBehindProvider.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/event/CacheEventListener.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/spi/loaderwriter/CacheLoadingException.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/service/DefaultCopierConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/CoreServiceConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/copy/package-  
 info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/offheap/portability/OffHeapValueHolderPortability.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/InternalStatus.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/statistics/ChainedOperationObserver.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngineProvider.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/tiering/CompoundCachingTier.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-

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jar/org/ehcache/core/config/ExpiryUtils.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/ValueStatistic.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/events/NullStoreEventDispatcher.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/serialization/TransientStateRepository.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/DeleteOperation.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/persistence/DefaultLocalPersistenceServiceFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/internal/resilience/ThrowingResilienceStrategy.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/offheap/OffHeapStoreProviderFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/package-
info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/expiry/Expirations.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/persistence/DefaultDiskResourceServiceFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/copy/DefaultCopyProviderFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/events/CacheEventAdapter.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/internal/Jsr107CacheConfigurationParser.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/heap/holders/BaseOnHeapKey.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/resilience/RecoveryStore.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/copy/package-
info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/internal/util/ValueSuppliers.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/persistence/CacheManagerPersistenceConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/executor/DefaultExecutionServiceFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/events/CloseableStoreEventSink.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/store/InternalCacheManager.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/Cache.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/serialization/StringSerializer.java

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\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/store/AbstractWrapperStoreProvider.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/resilience/DefaultResilienceStrategyConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/serialization/PlainJavaSerializer.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/spi/loaderwriter/CacheWritingException.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/statistics/OperationStatistic.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/events/CacheEventDispatcherFactory.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/provider/PooledExecutionServiceConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/loaderwriter/writebehind/DefaultBatchingConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/CloseUtil.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/copy/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/spi/serialization/DefaultSerializationProviderFactory.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/model/Expiry.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/jsr107/EventListenerAdaptors.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/heap/holders/SerializedOnHeapValueHolder.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/builders/ConfigurationBuilder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/persistence/package-  
 info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/CacheServiceConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/WriteBehind.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/BinaryValueHolder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/jsr107/ExpiryPolicyToEhcacheExpiry.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/store/BaseStore.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/store/events/StoreEventFilter.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/offheap/portability/SerializerPortability.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/store/events/StoreEventListener.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-

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jar/org/ehcache/xml/provider/DefaultSerializationProviderConfigurationParser.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/store/disk/OffHeapDiskStoreProviderConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/resilience/DefaultResilienceStrategyProviderFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/util/ByteBufferInputStream.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/executor/PooledExecutionService.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/builders/CacheManagerConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/offheap/EhcacheOffHeapBackingMap.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/config/units/EntryUnit.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/InternalCache.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/ZeroOperationStatistic.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/persistence/FileBasedStateRepository.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/executor/ExecutorUtil.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/serialization/Serializer.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/ResourcePool.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/serialization/CompactJavaSerializer.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/EhcacheBase.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/service/Service.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/store/disk/package-info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/heap/SimpleBackend.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/events/EventDispatchTask.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/service/DefaultResilienceStrategyConfigurationParser.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/serialization/StatefulSerializer.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/resilience/package-
info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/resilience/ResilienceStrategy.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/executor/PartitionedScheduledExecutor.java

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\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/BaseCacheConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/CacheConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/exceptions/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/service/ExecutionService.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/events/CacheEventDispatcher.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCacheLoaderWriterConfigurationParser.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/events/StateChangeListener.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/TimeSourceServiceFactory.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/spi/loaderwriter/DefaultCacheLoaderWriterProviderFactory.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/ResourceUnit.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/util/ServiceUtil.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/events/package-info.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/AuthoritativeTier.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapMapStatistics.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/provider/SimpleCoreServiceCreationConfigurationParser.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/service/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/store/Store.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/OnHeapStore.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterStoreProviderFactory.java

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/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/multi/XmlMultiConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/persistence/StateHolder.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/executor/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/service/ServiceConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-

jar/org/ehcache/impl/serialization/FloatSerializer.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterStoreProvider.java  
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 info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/jsr107/ListenerResources.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/StatusTransitioner.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/builders/CacheConfigurationBuilder.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/events/package-  
 info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/classes/ClassInstanceProviderConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107Cache.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 jar/org/ehcache/core/statistics/DefaultCacheStatistics.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/events/CacheEventListenerProvider.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/resilience/DefaultRecoveryStore.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/events/StoreEventDispatcher.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/serialization/package-info.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/jsr107/internal/tck/Eh107MBeanServerBuilder.java



\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/xml/service/SimpleCoreServiceConfigurationParser.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/DefaultCacheManagerProviderService.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/config/builders/CacheEventListenerConfigurationBuilder.java  
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 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/event/CacheEventDispatcherFactoryConfiguration.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/spi/service/ServiceFactory.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/core/CacheConfigurationChangeListener.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/event/package-info.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/StripedWriteBehind.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/config/loaderwriter/writebehind/DefaultWriteBehindConfiguration.java  
 \*  
 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/spi/loaderwriter/BulkCacheLoadingException.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/sizeof/listeners/EhcacheVisitorListener.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/NonBatchingLocalHeapWriteBehindQueue.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/config/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/store/heap/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/copy/SerializingCopier.java

\*

/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/HeuristicConfiguration.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/statistics/HigherCachingTierOperationOutcomes.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/service/StatisticsService.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/RobustResilienceStrategy.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Js107Service.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/spi/serialization/SerializationProvider.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/EhcacheCachingProvider.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapValueHolder.java

\*

/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/executor/PartitionedOrderedExecutor.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/provider/CacheManagerPersistenceConfigurationParser.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/factories/EhcacheSegmentFactory.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/xml/XmlModel.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/SwitchableEvictionAdvisor.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/serialization/LongSerializer.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/LookupOnlyOnHeapKey.java

\*

/opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/config/ResourceType.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/osgi/EhcacheActivator.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/EhcacheExpiryWrapper.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheMXBean.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/config/serializer/package-info.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/KeyBasedOperation.java

\* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Unwrap.java  
 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-  
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 /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/jsr107/Eh107Expiry.java  
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 info.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/osgi/SafeOsgi.java  
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 \* /opt/cola/permits/1268770701\_1644437856.4/0/ehcache-3-8-1-sources-

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jar/org/ehcache/spi/serialization/SerializerException.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/loaderwriter/LocalLoaderWriterStore.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/LatencyHistogramConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/event/DefaultCacheEventDispatcherConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/spi/service/package-
info.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/jsr107/Eh107CacheEntryEvent.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProviderFactory.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/expiry/Expiry.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/copy/DefaultCopyProvider.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/spi/loaderwriter/WriteBehindConfiguration.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/spi/store/heap/SizeOfEngineProvider.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/StoreOperationOutcomes.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/core/statistics/DefaultStatisticsServiceFactory.java
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/core/EhcacheManager.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/xml/CoreServiceCreationConfigurationParser.java

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* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-jar/org/ehcache/ValueSupplier.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/config/SizedResourcePoolImpl.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/store/tiering/CompoundCachingTierProviderFactory.java
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```

Found in path(s):

```
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/reflect/MethodUtils.java
*
/opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/ArrayUtils.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/ClassUtils.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/reflect/MemberUtils.java
* /opt/cola/permits/1268770701_1644437856.4/0/ehcache-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/reflect/ConstructorUtils.java
```

## 1.277 golang 1.15.15

### 1.277.1 Available under license :

```
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(and typically have contributed) code to the Go repository.
The AUTHORS file lists the copyright holders; this file
lists people. For example, Google employees are listed here
but not in AUTHORS, because Google holds the copyright.
#
```

```
Names should be added to this file only after verifying that
the individual or the individual's organization has agreed to
the appropriate Contributor License Agreement, found here:
#
http://code.google.com/legal/individual-cla-v1.0.html
http://code.google.com/legal/corporate-cla-v1.0.html
#
The agreement for individuals can be filled out on the web.

Names should be added to this file like so:
Individual's name <submission email address>
Individual's name <submission email address> <email2> <emailN>
#
An entry with multiple email addresses specifies that the
first address should be used in the submit logs and
that the other addresses should be recognized
as the
same person when interacting with Gerrit.

Please keep the list sorted.

Aamir Khan <syst3m.w0rm@gmail.com>
Aaron Beitch <aaronb@arista.com>
Aaron Bieber <deftly@gmail.com>
Aaron Cannon <cannona@fireantproductions.com>
Aaron France <aaron.l.france@gmail.com>
Aaron Jacobs <jacobsa@google.com>
Aaron Kemp <kemp.aaron@gmail.com>
Aaron Patterson <tenderlove@ruby-lang.org>
Aaron Stein <aaronstein12@gmail.com>
Aaron Torres <tcboox@gmail.com>
Aaron Zinman <aaron@azinman.com>
Aarti Parikh <aarti.parikh@gmail.com>
Abdullah Al Maruf <mymail.maruf@gmail.com>
Abe Haskins <abeisgreat@abeisgreat.com>
Abhinav Gupta <abhinav.g90@gmail.com>
Adam Azarchs <adam.azarchs@10xgenomics.com>
Adam Bender <abender@google.com>
Adam Eijdenberg <adam@continusec.com>
Adam Harvey <aharvey@php.net>
Adam Kisala <adam.kisala@gmail.com>
Adam Langley <agl@golang.org>
Adam Medzinski <adam.medzinski@gmail.com>
Adam Shannon <adamkshannon@gmail.com>
Adam Shelton <aashelt90@gmail.com>
Adam Sindelar <adamsh@google.com>
Adam
```

Thomason <athomason@gmail.com>  
Adam Williams <pwnfactory@gmail.com>  
Adam Woodbeck <adam@woodbeck.net>  
Adarsh Ravichandran <adarshravichandran91@gmail.com>  
Aditya Harindar <aditya.harindar@gmail.com>  
Aditya Mukerjee <dev@chimeracoder.net>  
Adrian Hesketh <adrianhesketh@hushmail.com>  
Adrian Nos <nos.adrian@gmail.com>  
Adrian O'Grady <elpollouk@gmail.com>  
Adrien Bustany <adrien-xx-google@bustany.org>  
Adrien Delorme <adrien.delorme@icloud.com>  
Adrien Petel <peteladrien@gmail.com>  
Acio Jnior <aeciodantasjunior@gmail.com>  
Aeneas Rekkas (arekkas) <aeneas@ory.am>  
Afanasev Stanislav <phpprogger@gmail.com>  
Agis Anastasopoulos <agis.anast@gmail.com>  
Agniva De Sarker <agnivade@yahoo.co.in>  
Ahmed Wahed <oneofone@gmail.com>  
Ahmet Alp Balkan <ahmetb@google.com>  
Ahmet Soormally <ahmet@mangomm.co.uk>  
Ahmy Yulrizka <yulrizka@gmail.com>  
Ahsun Ahmed <ahmed.ahsun@gmail.com>  
Aiden Scandella <ai@uber.com>  
Ainar Garipov <gugl.zadolbal@gmail.com>  
Aishraj Dahal <aishraj@users.noreply.github.com>  
Akhil Indurti  
<aindurti@gmail.com>  
Akihiro Suda <suda.kyoto@gmail.com>  
Akshat Kumar <seed@mail.nanosouffle.net>  
Al Cutter <al@google.com>  
Alan Braithwaite <alan@ipaddr.org>  
Alan Donovan <adonovan@google.com>  
Alan Shreve <alan@inconshreveable.com>  
Albert Nigmatzianov <albertnigma@gmail.com>  
Albert Strasheim <fullung@gmail.com>  
Albert Teoh <albert.teoh@gmail.com>  
Albert Yu <yukinying@gmail.com>  
Alberto Bertogli <albertito@blitiri.com.ar>  
Alberto Donizetti <alb.donizetti@gmail.com>  
Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>  
Alec Benzer <alec.benzer@gmail.com>  
Aleksa Sarai <cyphar@cyphar.com>  
Aleksandar Dezelin <dezelin@gmail.com>  
Aleksandr Lukinykh <a.lukinykh@xsolla.com>  
Aleksandr Razumov <ar@cydev.ru>  
Alekseev Artem <a.artem060@gmail.com>  
Alessandro Arzilli <alessandro.arzilli@gmail.com>  
Alessandro Baffa <alessandro.baffa@gmail.com>



Alex A Skinner <alex@lx.lc>  
Alex Brainman <alex.brainman@gmail.com>  
Alex Bramley <abramley@google.com>  
Alex Browne <stephenalexbrowne@gmail.com>  
Alex  
Buchanan <buchanae@gmail.com>  
Alex Carol <alex.carol.c@gmail.com>  
Alex Gaynor <alex@alloy.us>  
Alex Harford <alex.harford@saucelabs.com>  
Alex Jin <toalexjin@gmail.com>  
Alex Kohler <alexjohnkohler@gmail.com>  
Alex Myasoedov <msoedov@gmail.com>  
Alex Plugaru <alex@plugaru.org> <alexandru.plugaru@gmail.com>  
Alex Schroeder <alex@gnu.org>  
Alex Sergeev <abc@alexsergeev.com>  
Alex Tokarev <aleksator@gmail.com>  
Alex Vaghin <crhyme@google.com>  
Alex Zhirov <azhirov@google.com>  
Alexander Demakin <alexander.demakin@gmail.com>  
Alexander Dring <email@alex.d.ch>  
Alexander F Rdseth <alexander.rodseth@appeartv.com>  
Alexander Greim <alexxx@iltempo.de>  
Alexander Guz <kalimatas@gmail.com>  
Alexander Kauer <alexander@affine.space>  
Alexander Kucherenko <alxkchr@gmail.com>  
Alexander Larsson <alexander.larsson@gmail.com>  
Alexander Lourier <aml@rulezz.ru>  
Alexander Menzhinsky <amenzhinsky@gmail.com>  
Alexander Morozov <lk4d4math@gmail.com>  
Alexander Neumann <alexander@bumpem.de>  
Alexander  
Nohe <alex.nohe427@gmail.com>  
Alexander Orlov <alexander.orlov@loxal.net>  
Alexander Pantyukhin <apantykhin@gmail.com>  
Alexander Polcyn <apolcyn@google.com>  
Alexander Rakoczy <alex@golang.org>  
Alexander Reece <awreece@gmail.com>  
Alexander Surma <surma@surmair.de>  
Alexander Zhavnerchik <alex.vizor@gmail.com>  
Alexander Zillion <alex@alexzillion.com>  
Alexander Zolotov <goldifit@gmail.com>  
Alexandr Mayorskiy <a.mayorskiy@corp.mail.ru>  
Alexandre Cesaro <alexandre.cesaro@gmail.com>  
Alexandre Fiori <fiorix@gmail.com>  
Alexandre Maari <draeron@gmail.com>  
Alexandre Normand <alexandre.normand@gmail.com>  
Alexandre Parentea <aubonbeurre@gmail.com>  
Alexandre Viau <alexandre@alexandreviau.net>

Alexandru Mooi <brtznr@gmail.com>  
Alexei Sholik <alcosholik@gmail.com>  
Alexey Alexandrov <aalexand@google.com>  
Alexey Borzenkov <snaury@gmail.com>  
Alexey Naidonov <alexey.naidyonov@gmail.com>  
Alexey Neganov <neganovalexey@gmail.com>  
Alexey Palazhchenko <alexey.palazhchenko@gmail.com>  
Alexey Semenyuk <alexsemenyuk88@gmail.com>  
Alexis  
Hildebrandt <surryhill@gmail.com>  
Alexis Hunt <lexer@google.com>  
Alexis Imperial-Legrand <ail@google.com>  
Ali Farooq <ali.farooq0@pm.me>  
Ali Rizvi-Santiago <arizvisa@gmail.com>  
Aliaksandr Valialkin <valyala@gmail.com>  
Alif Rachmawadi <subosito@gmail.com>  
Allan Simon <allan.simon@supinfo.com>  
Allen Li <ayatane@google.com>  
Alok Menghrajani <alok.menghrajani@gmail.com>  
Aman Gupta <aman@tmm1.net>  
Amarjeet Anand <amarjeetanandsingh@gmail.com>  
Amir Mohammad Saied <amir@gluegadget.com>  
Amr Mohammed <merodiro@gmail.com>  
Amrut Joshi <amrut.joshi@gmail.com>  
An Long <aisk1988@gmail.com>  
An Xiao <hac@zju.edu.cn>  
Anand K. Mistry <anand@mistry.ninja>  
Anders Pearson <anders@columbia.edu>  
Anderson Queiroz <contato@andersonq.eti.br>  
Andr Carvalho <asantostc@gmail.com>  
Andr Martins <aanm90@gmail.com>  
Andre Nathan <andrenth@gmail.com>  
Andrea Nodari <andrea.nodari91@gmail.com>  
Andrea Spadaccini <spadaccio@google.com>  
Andreas Auernhammer <aead@mail.de>  
Andreas Jellinghaus <andreas@ionisiert.de>  
<anj@google.com>  
Andreas Litt <andreas.litt@gmail.com>  
Andrei Enshin <b1os@bk.ru>  
Andrei Gherzan <andrei@resin.io>  
Andrei Korzhevskii <a.korzhevskiy@gmail.com>  
Andrei Matei <andrei@cockroachlabs.com>  
Andrei Tudor Clin <mail@acln.ro>  
Andrei Vagin <avagin@google.com>  
Andrei Vieru <euvieru@gmail.com>  
Andres Erbsen <andreser@google.com>  
Andres Lowrie <andres.lowrie@gmail.com>  
Andrew Austin <andrewacht@gmail.com>

Andrew Balholm <andybalholm@gmail.com>  
Andrew Benton <andrewmbenton@gmail.com>  
Andrew Bonventre <andybons@chromium.org>  
Andrew Braunstein <awbraunstein@gmail.com>  
Andrew Bursavich <abursavich@gmail.com>  
Andrew Ekstedt <andrew.ekstedt@gmail.com>  
Andrew Etter <andrew.etter@gmail.com>  
Andrew G. Morgan <agm@google.com>  
Andrew Gerrand <adg@golang.org>  
Andrew Harding <andrew@spacemonkey.com>  
Andrew Jackura <ajackura@google.com>  
Andrew Louis <alouis@digitalocean.com>  
Andrew Lutomirski <andy@luto.us>  
Andrew Medvedev <andrew.y.medvedev@gmail.com>  
Andrew Pilloud <andrewpilloud@igneoussystems.com>  
Andrew  
Pogrebnoy <absourd.noise@gmail.com>  
Andrew Poydence <apoydence@pivotal.io>  
Andrew Pritchard <awpritchard@gmail.com>  
Andrew Radev <andrey.radev@gmail.com>  
Andrew Skiba <skibaa@gmail.com>  
Andrew Stormont <astormont@racktopsystems.com>  
Andrew Stribblehill <ads@wompom.org>  
Andrew Szeto <andrew@jabagawee.com>  
Andrew Todd <andrew.todd@wework.com>  
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>  
Andrew Wilkins <axwalk@gmail.com>  
Andrew Williams <williams.andrew@gmail.com>  
Andrew Z Allen <me@andrewzallen.com>  
Andrey Mirtchovski <mirtchovski@gmail.com>  
Andrey Petrov <andrey.petrov@shazow.net>  
Andrii Soldatenko <andrii.soldatenko@gmail.com>  
Andrii Soluk <isoluchok@gmail.com>  
Andriy Lytvynov <lytvynov.a.v@gmail.com>  
Andrzej eel <andrii.zhezhel@gmail.com>  
Andy Balholm <andy@balholm.com>  
Andy Davis <andy@bigandian.com>  
Andy Finkenstadt <afinkenstadt@zynga.com>  
Andy Lindeman <andy@lindeman.io>  
Andy Maloney <asmaloney@gmail.com>  
Andy Pan <panjf2000@gmail.com>  
Andy Walker  
<walkeraj@gmail.com>  
Andy Wang <cbeuw.andym@gmail.com>  
Andzej Maciusovic <andzej.maciusovic@gmail.com>  
Anfernee Yongkun Gui <anfernee.gui@gmail.com>  
Angelo Bulfone <mbulfone@gmail.com>  
Anh Hai Trinh <anh.hai.trinh@gmail.com>

Anit Gandhi <anitgandhi@gmail.com>  
Ankit Goyal <ankit3goyal@gmail.com>  
Anmol Sethi <anmol@aubble.com>  
Annirudh Prasad <annirudh@wandb.com>  
Anschel Schaffer-Cohen <anschelsc@gmail.com>  
Anthony Alves <cvballa3g0@gmail.com>  
Anthony Canino <anthony.canino1@gmail.com>  
Anthony Eufemio <anthony.eufemio@gmail.com>  
Anthony Fok <foka@debian.org>  
Anthony Martin <ality@pbrane.org>  
Anthony Sottile <asottile@umich.edu>  
Anthony Starks <ajstarks@gmail.com>  
Anthony Voutas <voutasaurus@gmail.com>  
Anthony Woods <awoods@raintank.io>  
Antoine GIRARD <sapk@sapk.fr>  
Antoine Martin <antoine97.martin@gmail.com>  
Anton Gyllenberg <anton@iki.fi>  
Anton Kuklin <anton.a.kuklin@gmail.com>  
Antonin Amand <antonin.amand@gmail.com>  
Antonio Antelo <aantelov87@gmail.com>  
Antonio Bibiano <antbbn@gmail.com>  
Antonio  
Huete Jimenez <tuxillo@quantumachine.net>  
Antonio Murdaca <runcom@redhat.com>  
Antonio Troina <thoeni@gmail.com>  
Anze Kolar <me@akolar.com>  
Aofei Sheng <aofei@aofeisheng.com>  
Apisak Darakananda <pongad@gmail.com>  
Aram Hvrneanu <aram@mgk.ro>  
Araragi Hokuto <kanseihonbucho@protonmail.com>  
Arash Bina <arash@arash.io>  
Arda Gl <ardaguclu@gmail.com>  
Areski Belaid <areski@gmail.com>  
Ariel Mashraki <ariel@mashraki.co.il>  
Arkadi Pyuro <arkadi@google.com>  
Arlo Breault <arlolra@gmail.com>  
Arnaud Ysmal <arnaud.ysmal@gmail.com>  
Arne Hormann <arnehormann@gmail.com>  
Arnout Engelen <arnout@bzzt.net>  
Aron Nopanen <aron.nopanen@gmail.com>  
Artem Alekseev <artem.alekseev@intel.com>  
Artem Kolin <artemkaxboy@gmail.com>  
Arthur Fabre <arthur@arthurfabre.com>  
Arthur Khashaev <arthur@khashaev.ru>  
Artyom Pervukhin <artyom.pervukhin@gmail.com>  
Arvindh Rajesh Tamilmani <art@a-30.net>  
Ashish Gandhi <ag@ashishgandhi.org>  
Asim Shankar <asimshankar@gmail.com>

Atin Malaviya <amalaviy@akamai.com>  
Ato Araki  
<ato.araki@gmail.com>  
Audrey Lim <audreylh@gmail.com>  
Audrius Butkevicius <audrius.butkevicius@gmail.com>  
Augusto Roman <aroman@gmail.com>  
Aulus Egnatius Varialus <varialus@gmail.com>  
Aurlien Rainone <aurelien.rainone@gmail.com>  
Aurlio A. Heckert <aurium@gmail.com>  
Austin Clements <austin@google.com> <aclements@csail.mit.edu>  
Avi Flax <avi@timehop.com>  
awaw fumin <awawfumin@gmail.com>  
Awn Umar <awn@cryptolosophy.io>  
Axel Wagner <axel.wagner.hh@googlemail.com>  
Ayan George <ayan@ayan.net>  
Ayanamist Yang <ayanamist@gmail.com>  
Ayke van Laethem <aykevanlaethem@gmail.com>  
Aymerick Jhanne <aymerick@jehanne.org>  
Azat Kaumov <kaumov.a.r@gmail.com>  
Baiju Muthukadan <baiju.m.mail@gmail.com>  
Balaram Makam <bmakam.qdt@qualcommdatacenter.com>  
Balazs Lecz <leczb@google.com>  
Baokun Lee <nototon@gmail.com>  
Barnaby Keene <accounts@southcla.ws>  
Bartosz Grzybowski <melkorm@gmail.com>  
Bartosz Oler <brtsz@google.com>  
Bastian Ike <bastian.ike@gmail.com>  
Ben Burkert <ben@benburkert.com>  
Ben Eitzen <eitzenb@golang.org>  
Ben  
Fried <ben.fried@gmail.com>  
Ben Haines <bhainesva@gmail.com>  
Ben Hoyt <benhoyt@gmail.com>  
Ben Laurie <ben@links.org> <benl@google.com>  
Ben Lubar <ben.lubar@gmail.com>  
Ben Lynn <benlynn@gmail.com>  
Ben Olive <sionide21@gmail.com>  
Ben Schwartz <bemasc@google.com>  
Ben Shi <powerman1st@163.com>  
Ben Toews <mastahyeti@gmail.com>  
Benjamin Black <b@b3k.us>  
Benjamin Cable <cable.benjamin@gmail.com>  
Benjamin Hsieh <tanookiben@users.noreply.github.com>  
Benjamin Peterson <benjamin@python.org>  
Benjamin Prosnitz <bprosnitz@google.com>  
Benjamin Wester <bwester@squareup.com>  
Benjamin Wuethrich <benjamin.wuethrich@gmail.com>  
Benny Siegert <bsiegert@gmail.com>

Benoit Sigoure <tsunenet@gmail.com>  
Berengar Lehr <Berengar.Lehr@gmx.de>  
Berkant Ipek <41230766+0xbkt@users.noreply.github.com>  
Bharath Thiruveedula <tbharath91@gmail.com>  
Bhavin Gandhi <bhavin7392@gmail.com>  
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>  
Bill O'Farrell <billo@ca.ibm.com>  
Bill Prin <waprin@google.com>  
Bill  
Thiede <couchmoney@gmail.com>  
Bill Zissimopoulos <billziss@navimatics.com>  
Billie Harold Cleek <bhcleek@gmail.com>  
Billy Lynch <wlynch@google.com>  
Billy Zaelani Malik <m.billyzaelani@gmail.com>  
Bjrn Erik Pedersen <bjorn.erik.pedersen@gmail.com>  
Bjorn Tillenius <bjorn@tillenius.me>  
Bjorn Tipling <bjorn.tipling@gmail.com>  
Blain Smith <rebelgeek@blainsmith.com>  
Blake Gentry <blakesgentry@gmail.com>  
Blake Mesdag <blakemesdag@gmail.com>  
Blake Mizerany <blake.mizerany@gmail.com>  
Blixt <me@blixt.nyc>  
Bob Briski <rbriski@gmail.com>  
Bob McNaughton <bobmcn@gmail.com>  
Bob Potter <bobby.potter@gmail.com>  
Bobby DeSimone <bobbydesimone@gmail.com>  
Bobby Powers <bobbypowers@gmail.com>  
Boqin Qin <bobbqqin@gmail.com>  
Boris Nagaev <nagaev@google.com>  
Borja Clemente <borja.clemente@gmail.com>  
Brad Burch <brad.burch@gmail.com>  
Brad Erickson <bderickson@gmail.com>  
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>  
Brad Garcia <bgarcia@golang.org>  
Brad Jones <rbjones@google.com>  
Brad  
Morgan <brad@morgabra.com>  
Brad Whitaker <bwhitaker@fastly.com>  
Braden Bassingthwaite <bbassingthwaite@vendasta.com>  
Bradford Lamson-Scribner <brad.lamson@gmail.com>  
Bradley Falzon <brad@teambrad.net>  
Brady Catherman <brady@gmail.com>  
Brady Sullivan <brady@bsull.com>  
Brandon Bennett <bbennett@fb.com>  
Brandon Gilmore <varz@google.com>  
Brandon Philips <brandon@ifup.org>  
Brandon Ryan <bjryan19@gmail.com>  
Brayden Cloud <bcloud@google.com>

Brendan Daniel Tracey <tracey.brendan@gmail.com>  
Brendan O'Dea <bod@golang.org>  
Brett Cannon <bcannon@gmail.com>  
Brett Merrill <brett.j.merrill94@gmail.com>  
Brian Dellisanti <briandellisanti@gmail.com>  
Brian Downs <brian.downs@gmail.com>  
Brian Falk <falk@logicparty.org>  
Brian G. Merrell <bgmerrell@gmail.com>  
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com> <bgm@google.com>  
Brian Kennedy <btkenedy@gmail.com>  
Brian Kessler <brian.m.kessler@gmail.com>  
Brian Ketelsen <bketelsen@gmail.com>  
Brian Slesinsky <skybrian@google.com>  
Brian Smith <ohohvi@gmail.com>  
Brian  
Starke <brian.starke@gmail.com>  
Bryan Alexander <Kozical@msn.com>  
Bryan C. Mills <bcmills@google.com>  
Bryan Chan <bryan.chan@ca.ibm.com>  
Bryan Ford <brynosaurus@gmail.com>  
Bryan Heden <b.heden@gmail.com>  
Bulat Gaifullin <gaifullinbf@gmail.com>  
Burak Guven <bguven@gmail.com>  
Caine Tighe <arctanofyourface@gmail.com>  
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>  
Caleb Martinez <accounts@calebmartinez.com>  
Caleb Spare <cespare@gmail.com>  
Carl Chatfield <carlchatfield@gmail.com>  
Carl Henrik Lunde <chlunde@ifi.uio.no>  
Carl Jackson <carl@stripe.com>  
Carl Johnson <me@carlmjohnson.net>  
Carl Mastrangelo <notcarl@google.com>  
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>  
Carlisia Campos <carlisia@grokkingtech.io>  
Carlo Alberto Ferraris <cafxx@strayorange.com>  
Carlos Amedee <carlos@golang.org>  
Carlos Castillo <cookieo9@gmail.com>  
Carlos Cirello <uldericofilho@gmail.com>  
Carlos Eduardo <me@carlosedp.com>  
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>  
Carlos Iriarte  
<ciriarte@gmail.com>  
Carlos Souza <carloshrsouza@gmail.com>  
Carolyn Van Slyck <me@carolynvanslyck.com>  
Carrie Bynon <cbynon@gmail.com>  
Cary Hull <chull@google.com>  
Case Nelson <case.nelson@gmail.com>  
Casey Callendrello <squeed@gmail.com>

Casey Marshall <casey.marshall@gmail.com>  
Catalin Nicutar <cnicutar@google.com>  
Catalin Patulea <catalinp@google.com>  
Cedric Staub <cs@squareup.com>  
Cezar S Espinola <cezarsa@gmail.com>  
Chad Rosier <mrosier.qdt@qualcommdatacenter.com>  
ChaiShushan <chaishushan@gmail.com>  
Changkun Ou <hi@changkun.us>  
Channing Kimble-Brown <channing@golang.org>  
Chao Xu <xuchao@google.com>  
Charles Fenwick Elliott <Charles@FenwickElliott.io>  
Charles Kenney <charlesc.kenney@gmail.com>  
Charles L. Dorian <cldorian@gmail.com>  
Charles Lee <zombie.fml@gmail.com>  
Charles Weill <weill@google.com>  
Chauncy Cullitan <chauncyc@google.com>  
Chen Zhihan <energiehund@gmail.com>  
Cherry Zhang <cherryyz@google.com>  
Chew Choon Keat <choonkeat@gmail.com>  
Cholerae Hu <choleraehyq@gmail.com>  
Chotepud  
Teo <AlexRouSg@users.noreply.github.com>  
Chris Ball <chris@printf.net>  
Chris Biscardi <chris@christopherbiscardi.com>  
Chris Broadfoot <cbro@golang.org>  
Chris Dollin <ehog.hedge@gmail.com>  
Chris Farmiloe <chrisfarms@gmail.com>  
Chris Hines <chris.cs.guy@gmail.com>  
Chris Howey <howeyc@gmail.com>  
Chris Hundt <hundt@google.com>  
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>  
Chris Kastorff <encryptio@gmail.com>  
Chris Le Roy <brompwnie@users.noreply.github.com>  
Chris Lennert <calennert@gmail.com>  
Chris Liles <caveryliles@gmail.com>  
Chris Manghane <cmang@golang.org>  
Chris Marchesi <chrism@vanclueverttech.com>  
Chris McGee <sirnewton\_01@yahoo.ca> <newton688@gmail.com>  
Chris Raynor <raynor@google.com>  
Chris Roche <rodaine@gmail.com>  
Chris Smith <chrsmith@users.noreply.github.com>  
Chris Stockton <chrisstocktonaz@gmail.com>  
Chris Zou <chriszou@ca.ibm.com>  
Christian Alexander <christian@linux.com>  
Christian Couder <chriscool@tuxfamily.org>  
Christian Himpel <chressie@googlemail.com>  
<chressie@gmail.com>  
Christian Muehlhaeuser <muesli@gmail.com>



Christian Pellegrin <chri@evolware.org>  
Christian R. Petrin <christianpetrin@gmail.com>  
Christine Hansmann <chhansmann@gmail.com>  
Christoffer Buchholz <christoffer.buchholz@gmail.com>  
Christoph Blecker <admin@toph.ca>  
Christoph Hack <christoph@tux21b.org>  
Christopher Cahoon <chris.cahoon@gmail.com>  
Christopher Guiney <chris@guiney.net>  
Christopher Henderson <chris@chenderson.org>  
Christopher Koch <chrisko@google.com>  
Christopher Loessl <cloessl+github@gmail.com>  
Christopher Nelson <nadiasvertex@gmail.com>  
Christopher Nielsen <m4dh4tt3r@gmail.com>  
Christopher Redden <christopher.redden@gmail.com>  
Christopher Swenson <cswenson@google.com>  
Christopher Wedgwood <cw@f00f.org>  
Christos Zoulas <christos@zoulas.com> <zoulasc@gmail.com>  
Christy Perez <christy@linux.vnet.ibm.com>  
CL Sung <clsung@gmail.com> <cl\_sung@htc.com>  
Clment Chigot <clement.chigot@atos.net>  
Clement Skau <clementskaug@gmail.com>  
Clint J. Edwards <clint.j.edwards@gmail.com>  
Cody  
Oss <the.cody.oss@gmail.com>  
Colby Ranger <cranger@google.com>  
Colin Arnott <colin@urandom.co.uk>  
Colin Cross <ccross@android.com>  
Colin Edwards <colin@recursivepenguin.com>  
Colin Kennedy <moshen.colin@gmail.com>  
Colin Nelson <colnnelson@google.com>  
Colin Rice <clr@google.com>  
Conrad Irwin <conrad.irwin@gmail.com>  
Conrad Meyer <cemeyer@cs.washington.edu>  
Conrado Gouvea <conradopl@gmail.com>  
Constantin Konstantinidis <constantinkonstantinidis@gmail.com>  
Corey Thomasson <cthom.lists@gmail.com>  
Corne van der Plas <vdplas@gmail.com>  
Cosmos Nicolaou <cnicolaou@google.com>  
Costin Chirvasuta <ctin@google.com>  
Craig Citro <craigcitro@google.com>  
Cristian Staretu <unclejacksons@gmail.com>  
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>  
Cyrill Schumacher <cyrill@schumacher.fm>  
Daisuke Fujita <dtanshi45@gmail.com>  
Daisuke Suzuki <daisuzu@gmail.com>  
Daker Fernandes Pinheiro <daker.fernandes.pinheiro@intel.com>  
Damian Gryski <dgryski@gmail.com>  
Damien Lespiau <damien.lespiau@gmail.com>

<damien.lespiau@intel.com>  
Damien Mathieu <42@dmathieu.com>  
Damien Neil <dneil@google.com>  
Damien Tournoud <damien@platform.sh>  
Dan Ballard <dan@mindstab.net>  
Dan Caddigan <goldcaddy77@gmail.com>  
Dan Callahan <dan.callahan@gmail.com>  
Dan Harrington <harringtond@google.com>  
Dan Jacques <dnj@google.com>  
Dan Johnson <computerdruid@google.com>  
Dan Peterson <dpiddy@gmail.com>  
Dan Pupius <dan@medium.com>  
Dan Scales <danscales@google.com>  
Dan Sinclair <dan.sinclair@gmail.com>  
Daniel Cormier <danielc@knowbe4.com>  
Danil de Kok <me@danieldk.eu>  
Daniel Fleischman <danielfleischman@gmail.com>  
Daniel Ingram <ingramds@appstate.edu>  
Daniel Johansson <dajo2002@gmail.com>  
Daniel Kerwin <d.kerwin@gini.net>  
Daniel Krech <eikeon@eikeon.com>  
Daniel Kumor <rdkumor@gmail.com>  
Daniel Langner <s8572327@gmail.com>  
Daniel Lidn <daniel.liden.87@gmail.com>  
Daniel Lublin <daniel@lublin.se>  
Daniel Mangum <georgedanielmangum@gmail.com>  
Daniel Mart <mvdan@mvdan.cc>  
Daniel Morsing <daniel.morsing@gmail.com>  
Daniel  
Nadasi <dnadasi@google.com>  
Daniel Nephin <dnephin@gmail.com>  
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>  
Daniel Skinner <daniel@dasa.cc>  
Daniel Speichert <daniel@speichert.pl>  
Daniel Theophanes <kardianos@gmail.com>  
Daniel Upton <daniel@floppy.co>  
Daniela Petruzalek <daniela.petruzalek@gmail.com>  
Danish Dua <danishdua@google.com>  
Danish Prakash <grafitykoncept@gmail.com>  
Danny Rosseau <daniel.rosseau@gmail.com>  
Daria Kolistratova <daria.kolistratova@intel.com>  
Darien Raymond <admin@v2ray.com>  
Darren Elwood <darren@textnode.com>  
Darren Grant <darren.e.grant@gmail.com>  
Darren McCleary <darren.rmc@gmail.com>  
Darshan Parajuli <parajulidarshan@gmail.com>  
Datong Sun <dndx@idndx.com>  
Dave Borowitz <dborowitz@google.com>

Dave Bort <dbort@golang.org>  
Dave Cheney <dave@cheney.net>  
Dave Day <djd@golang.org>  
Dave Grijalva <dgrijalva@ngmoco.com>  
Dave MacFarlane <driusan@gmail.com>  
Dave Russell <forfuncsake@gmail.com>  
David Anderson <danderson@google.com>  
David Barnett <dbarnett@google.com>  
David  
Benjamin <davidben@google.com>  
David Bond <davidsbond93@gmail.com>  
David Brophy <dave@brophy.uk>  
David Brgin <676c7473@gmail.com>  
David Calavera <david.calavera@gmail.com>  
David Carlier <devnexen@gmail.com>  
David Carter <fresco.raja@gmail.com>  
David Chase <drchase@google.com>  
David Covert <davidhcovert@gmail.com>  
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>  
David du Colombier <0intro@gmail.com>  
David Finkel <david.finkel@gmail.com>  
David Forsythe <dforsythe@gmail.com>  
David G. Andersen <dave.andersen@gmail.com>  
David Glasser <glasser@meteor.com>  
David Golden <david@autopragmatic.com>  
David Heuschmann <heuschmann.d@gmail.com>  
David Howden <dhowden@gmail.com>  
David Hubbard <dsp@google.com>  
David Jakob Fritz <david.jakob.fritz@gmail.com>  
David Jones <dxjones@gmail.com>  
David Lazar <lazard@golang.org>  
David Leon Gil <coruus@gmail.com>  
David McLeish <davemc@google.com>  
David Ndungu <dnjuguna@gmail.com>  
David NewHamlet <david@newhamlet.com>  
David  
Presotto <presotto@gmail.com>  
David R. Jenni <david.r.jenni@gmail.com>  
David Sansome <me@davidsansome.com>  
David Stainton <dstainton415@gmail.com>  
David Symonds <dsymonds@golang.org>  
David Thomas <davidthomas426@gmail.com>  
David Timm <dtimm@pivotal.io>  
David Titarenco <david.titarenco@gmail.com>  
David Tolpin <david.tolpin@gmail.com>  
David Url <david@urld.io>  
David Volquartz Lebech <david@lebech.info>  
David Wimmer <davidlwimmer@gmail.com>

Davies Liu <davies.liu@gmail.com>  
Davor Kapsa <davor.kapsa@gmail.com>  
Dean Eigenmann <7621705+decanus@users.noreply.github.com>  
Dean Prichard <dean.prichard@gmail.com>  
Deepak Jois <deepak.jois@gmail.com>  
Denis Bernard <db047h@gmail.com>  
Denis Brandolini <denis.brandolini@gmail.com>  
Denis Isaev <idenx@yandex.com>  
Denis Nagorny <denis.nagorny@intel.com>  
Dennis Kuhnert <mail.kuhnert@gmail.com>  
Denys Honsiorovskyi <honsiorovskyi@gmail.com>  
Denys Smirnov <denis.smirnov.91@gmail.com>  
Derek Buitenhuis <derek.buitenhuis@gmail.com>  
Derek  
Che <drc@yahoo-inc.com>  
Derek McGowan <derek@mcgstyle.net>  
Derek Parker <parkerderek86@gmail.com>  
Derek Phan <derekphan94@gmail.com>  
Derek Shockey <derek.shockey@gmail.com>  
Dev Ojha <dojha12@gmail.com>  
Dev Zhoujun <dev.zhoujun@gmail.com>  
Devon H. O'Dell <devon.odell@gmail.com>  
Dhaivat Pandit <dhaivatpandit@gmail.com>  
Dhananjay Nakrani <dhananjayn@google.com>  
Dhiru Kholia <dhiru.kholia@gmail.com>  
Dhruvdudd Jadhav <dhruvdudd.jadhav@gmail.com>  
Di Xiao <dixiao@google.com>  
Didier Spezia <didier.06@gmail.com>  
Diego Siqueira <diego9889@gmail.com>  
Dieter Plaetinck <dieter@raintank.io>  
Dimitri Sokolyuk <sokolyuk@gmail.com>  
Dimitri Tcaciuc <dtcaciuc@gmail.com>  
Dina Garmash <dgrmsh@gmail.com>  
Diogo Pinela <diogoid7400@gmail.com>  
Dirk Gadsden <dirk@esherido.com>  
Diwaker Gupta <diwakergupta@gmail.com>  
Dmitri Goutnik <dgoutnik@gmail.com>  
Dmitri Popov <operator@cv.dp-net.com>  
Dmitri Shuralyov <dmitshur@golang.org> <dmitri@shuralyov.com>  
Dmitriy Cherchenko <dcherchenko@gmail.com>  
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>  
Dmitriy  
Shelenin <deemok@googlemail.com> <deemok@gmail.com>  
Dmitriy Vyukov <dvyukov@google.com>  
Dmitry Chestnykh <dchest@gmail.com>  
Dmitry Doroginin <doroginin@gmail.com>  
Dmitry Mottl <dmitry.mottl@gmail.com>  
Dmitry Neverov <dmitry.neverov@gmail.com>

Dmitry Savintsev <dsavints@gmail.com>  
Dmitry Yakunin <nonamezeil@gmail.com>  
Doga Fincan <doga@icloud.com>  
Domas Tamauskas <puerdomus@gmail.com>  
Domen Ipavec <domen@ipavec.net>  
Dominic Green <dominicgreen1@gmail.com>  
Dominik Honnef <dominik.honnef@gmail.com>  
Dominik Vogt <vogt@linux.vnet.ibm.com>  
Don Byington <don@dbyington.com>  
Donald Huang <don.hcd@gmail.com>  
Dong-hee Na <donghee.na92@gmail.com>  
Donovan Hide <donovanhide@gmail.com>  
Doug Anderson <douga@google.com>  
Doug Fawley <dfawley@google.com>  
Douglas Danger Manley <doug.manley@gmail.com>  
Drew Flower <drewvanstone@gmail.com>  
Drew Hintz <adhintz@google.com>  
Duco van Amstel <duco.vanamstel@gmail.com>  
Duncan Holm <mail@frou.org>  
Dustin Carlino <dcarlino@google.com>  
Dustin  
Herbison <djherbis@gmail.com>  
Dustin Long <dustmop@gmail.com>  
Dustin Sallings <dsallings@gmail.com>  
Dustin Shields-Cloues <dcloues@gmail.com>  
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>  
Dylan Waits <dylan@waits.io>  
Ed Schouten <ed@nuxi.nl>  
Edan Bedrik <3d4nb3@gmail.com>  
Eddie Scholtz <escholtz@google.com>  
Eden Li <eden.li@gmail.com>  
Eduard Urbach <e.urbach@gmail.com>  
Eduardo Ramalho <eduardo.ramalho@gmail.com>  
Eduardo Villaseor <evillasrmx@gmail.com>  
Edward Muller <edwardam@interlix.com>  
Egon Elbre <egonelbre@gmail.com>  
Ehren Kret <ehren.kret@gmail.com>  
Eitan Adler <lists@eitanadler.com>  
Eivind Uggedal <eivind@uggedal.com>  
Elbert Fliek <efliek@gmail.com>  
Eldar Rakhimberdin <ibeono@gmail.com>  
Elena Grahovac <elena@grahovac.me>  
Eli Bendersky <eliben@google.com>  
Elias Naur <mail@eliasnaur.com> <elias.naur@gmail.com>  
Elliot Morrison-Reed <elliotmr@gmail.com>  
Ellison Leao <ellisonleao@gmail.com>  
Emerson Lin <linyintor@gmail.com>  
Emil Hessman <emil@hessman.se>

Emil Mursalimov <mursalimovemeel@gmail.com>  
Emilien  
Kenler <hello@emilienkenler.com>  
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>  
Emreacan Bati <emreacanbati@gmail.com>  
Eno Compton <enocom@google.com>  
Eoghan Sherry <ejsherry@gmail.com>  
Eric Biggers <ebiggers@google.com>  
Eric Brown <browne@vmware.com>  
Eric Chiang <eric.chiang.m@gmail.com>  
Eric Clark <zerohp@gmail.com>  
Eric Daniels <eric@erdaniels.com>  
Eric Engestrom <eric@engestrom.ch>  
Eric Garrido <ekg@google.com>  
Eric Koleda <ekoleda+devrel@google.com>  
Eric Lagergren <ericscottlagergren@gmail.com>  
Eric Milliken <emilliken@gmail.com>  
Eric Pauley <eric@pauley.me>  
Eric Ponce <tricokun@gmail.com>  
Eric Rescorla <ekr@rtfm.com>  
Eric Roshan-Eisner <eric.d.eisner@gmail.com>  
Eric Rutherford <erutherford@gmail.com>  
Eric Rykwalder <e.rykwalder@gmail.com>  
Erick Tryzelaar <etryzelaar@google.com>  
Erik Aigner <aigner.erik@gmail.com>  
Erik Dubbelboer <erik@dubbelboer.com>  
Erik St. Martin <alakriti@gmail.com>  
Erik Staab <estaab@google.com>  
Erik Westrup <erik.westrup@gmail.com>  
Erin  
Masatsugu <erin.masatsugu@gmail.com>  
Ernest Chiang <ernest\_chiang@htc.com>  
Erwin Oegema <blablaechthema@hotmail.com>  
Esko Luontola <esko.luontola@gmail.com>  
Ethan Burns <eaburns@google.com>  
Ethan Miller <eamiller@us.ibm.com>  
Euan Kemp <euank@euank.com>  
Eugene Formanenko <mo4islona@gmail.com>  
Eugene Kalinin <e.v.kalinin@gmail.com>  
Evan Broder <evan@stripe.com>  
Evan Brown <evanbrown@google.com>  
Evan Digby <evandigby@gmail.com>  
Evan Hicks <evan.hicks2@gmail.com>  
Evan Jones <ej@evanjones.ca>  
Evan Klitzke <evan@eklitzke.org>  
Evan Kroske <evankroske@google.com>  
Evan Martin <evan.martin@gmail.com>  
Evan Phoenix <evan@phx.io>

Evan Shaw <chickencha@gmail.com>  
Evgeniy Kulikov <tuxuls@gmail.com>  
Evgeniy Polyakov <zbr@ioremap.net>  
Ewan Chou <coocood@gmail.com>  
Ewan Valentine <ewan.valentine89@gmail.com>  
Eyal Posener <posener@gmail.com>  
Fabian Wickborn <fabian@wickborn.net>  
Fabian Zaremba <fabian@youreemail.eu>  
Fabrizio Milo <mistobaan@gmail.com>  
Faiyaz Ahmed <ahmedf@vmware.com>  
Fan  
Hongjian <fan.howard@gmail.com>  
Fangming Fang <fangming.fang@arm.com>  
Fannie Zhang <fannie.zhang@arm.com>  
Fatih Arslan <fatih@arslan.io>  
Fazal Majid <majid@apsalar.com>  
Fazlul Shahriar <fshahriar@gmail.com>  
Federico Bond <federicobond@gmail.com>  
Federico Simoncelli <fsimonce@redhat.com>  
Fedor Indutny <fedor@indutny.com>  
Fedor Korotkiy <dartslon@gmail.com>  
Felipe Oliveira <felipeweb.programador@gmail.com>  
Felix Bnemann <Felix.Buenemann@gmail.com>  
Felix Cornelius <9767036+fcornelius@users.noreply.github.com>  
Felix Geisendrfer <haimuiba@gmail.com>  
Felix Kollmann <fk@konsorten.de>  
Ferenc Szabo <frncmx@gmail.com>  
Filip Gruszczyski <gruszczyski@gmail.com>  
Filip Haglund <drathier@users.noreply.github.com>  
Filip Stanis <fstanis@google.com>  
Filippo Valsorda <filippo@golang.org> <filippo@cloudflare.com> <hi@filippo.io>  
Firmansyah Adiputra <frm.adiputra@gmail.com>  
Florian Forster <octo@google.com>  
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>  
Florian Weimer <fw@deneb.enyo.de>  
Florin  
Patan <florinpatan@gmail.com>  
Folke Behrens <folke@google.com>  
Ford Hurley <ford.hurley@gmail.com>  
Francesc Campoy <campoy@golang.org>  
Francesco Renzi <rentziass@gmail.com>  
Francisco Claude <fclaud@recoded.cl>  
Francisco Rojas <francisco.rojas.gallegos@gmail.com>  
Francisco Souza <franciscossouza@gmail.com>  
Frank Schroeder <frank.schroeder@gmail.com>  
Frank Somers <fsomers@arista.com>  
Frederic Guillot <frederic.guillot@gmail.com>  
Frederick Kelly Mayle III <frederickmayle@gmail.com>

Frederik Ring <frederik.ring@gmail.com>  
Frederik Zipp <fzipp@gmx.de>  
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>  
Fredrik Forsmo <fredrik.forsmo@gmail.com>  
Fredrik Wallgren <fredrik.wallgren@gmail.com>  
Frew Schmidt <github@frew.co>  
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>  
Frits van Bommel <fvbommel@gmail.com>  
Fujimoto Kyosuke <kyoro.f@gmail.com>  
Fumitoshi Ukai <ukai@google.com>  
G. Hussain Chinoy <ghchinoy@gmail.com>  
Gaal Yahas <gaal@google.com>  
Gabrel  
Arthr Ptursson <gabriel@system.is>  
Gabriel Aszalos <gabriel.aszalos@gmail.com>  
Gabriel Guzman <gabe.guzman@gmail.com>  
Gabriel Nelle <tehsphinx@web.de>  
Gabriel Nicolas Avellaneda <avellaneda.gabriel@gmail.com>  
Gabriel Rosenhouse <rosenhouse@gmail.com>  
Gabriel Russell <gabriel.russell@gmail.com>  
Gareth Paul Jones <gpj@foursquare.com>  
Garret Kelly <gdk@google.com>  
Garrick Evans <garrick@google.com>  
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>  
Gary Elliott <garyelliott@google.com>  
Gaurish Sharma <contact@aurishsharma.com>  
Gautham Thambidorai <gautham.dorai@gmail.com>  
Gauthier Jolly <gauthier.jolly@gmail.com>  
Gawen Arab <gawen.arab@c.zen.ly>  
Geert-Johan Riemer <gjr19912@gmail.com>  
Genevieve Luyt <genevieve.luyt@gmail.com>  
Gengliang Wang <ltnwgl@gmail.com>  
Geoff Berry <gberry.qdt@qualcommdatacenter.com>  
Geoffroy Lorieux <lorieux.g@gmail.com>  
Geon Kim <geon0250@gmail.com>  
Georg Reinke <guelfey@gmail.com>  
George Gkirtsou <ggirtsou@gmail.com>  
George Hartzell <hartzell@alerce.com>  
George  
Shammas <george@shamm.as> <georgyo@gmail.com>  
Gerasimos (Makis) Maropoulos <kataras2006@hotmail.com>  
Gerasimos Dimitriadis <gedimitr@gmail.com>  
Gergely Brautigam <skarlso777@gmail.com>  
Gernot Vormayr <gvormayr@gmail.com>  
Gert Cuykens <gert.cuykens@gmail.com>  
Getulio Snchez <valentin2507@gmail.com>  
Ghazni Nattarshah <ghazni.nattarshah@gmail.com>  
Gianguido Sora` <g.sora4@gmail.com>



Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>  
Giles Lean <giles.lean@pobox.com>  
Giovanni Bajo <rasky@develer.com>  
GitHub User @aca (50316549) <acadx0@gmail.com>  
GitHub User @ajnrp (1688456) <ajnrp@users.noreply.github.com>  
GitHub User @ajz01 (4744634) <ajzdenek@gmail.com>  
GitHub User @alkesh26 (1019076) <alkesh26@gmail.com>  
GitHub User @andig (184815) <cpuidle@gmx.de>  
GitHub User @andrius4669 (4699695) <andrius4669@gmail.com>  
GitHub User @as (8127015) <as.utf8@gmail.com>  
GitHub User @bakape (7851952) <bakape@gmail.com>  
GitHub User @bgadrian (830001) <aditza8@gmail.com>  
GitHub User @bontequero  
(2674999) <bontequero@gmail.com>  
GitHub User @cch123 (384546) <buaa.cch@gmail.com>  
GitHub User @chainhelen (7046329) <chainhelen@gmail.com>  
GitHub User @chanxuehong (3416908) <chanxuehong@gmail.com>  
GitHub User @cncal (23520240) <flycalvin@qq.com>  
GitHub User @DQNEO (188741) <dqneo@gmail.com>  
GitHub User @Dreamacro (8615343) <chuainian@gmail.com>  
GitHub User @dupoxy (1143957) <dupoxy@users.noreply.github.com>  
GitHub User @erifan (31343225) <eric.fang@arm.com>  
GitHub User @esell (9735165) <eujon.sellers@gmail.com>  
GitHub User @fatedier (7346661) <fatedier@gmail.com>  
GitHub User @frenkie (6499251) <mail@rhab.de>  
GitHub User @geedchin (11672310) <geedchin@gmail.com>  
GitHub User @GrigoriyMikhalkin (3637857) <grigoriymikhalkin@gmail.com>  
GitHub User @hengwu0 (41297446) <41297446+hengwu0@users.noreply.github.com>  
GitHub User @itchyny (375258) <itchyny@hatena.ne.jp>  
GitHub User @jinmiaoluo (39730824) <jinmiaoluo@icloud.com>  
GitHub User @jobpbrown (6345470) <msshane2008@gmail.com>  
GitHub User  
@kazyshr (30496953) <kazyshr0301@gmail.com>  
GitHub User @kc1212 (1093806) <kc1212@users.noreply.github.com>  
GitHub User @Kropekk (13366453) <kamilkropiewnicki@gmail.com>  
GitHub User @linguohua (3434367) <lghchinaidea@gmail.com>  
GitHub User @LotusFenn (13775899) <fenn.lotus@gmail.com>  
GitHub User @ly303550688 (11519839) <yang.liu636@gmail.com>  
GitHub User @madiganz (18340029) <zacharywmadigan@gmail.com>  
GitHub User @maltalex (10195391) <code@bit48.net>  
GitHub User @Matts966 (28551465) <Matts966@users.noreply.github.com>  
GitHub User @micncim (21333876) <micncim@gmail.com>  
GitHub User @mkishere (224617) <224617+mkishere@users.noreply.github.com>  
GitHub User @nu50218 (40682920) <nu\_ll@icloud.com>  
GitHub User @OlgaVIPetrova (44112727) <OVPPetrova@gmail.com>  
GitHub User @pityonline (438222) <pityonline@gmail.com>  
GitHub User @po3rin (29445112) <abctail30@gmail.com>  
GitHub User @pokutuna (57545) <popopopokutuna@gmail.com>

GitHub User @pytimer (17105586) <lixin20101023@gmail.com>  
GitHub  
User @ramenjuniti (32011829) <ramenjuniti@gmail.com>  
GitHub User @saitarunreddy (21041941) <saitarunreddypalla@gmail.com>  
GitHub User @shogo-ma (9860598) <Choroma194@gmail.com>  
GitHub User @skanehira (7888591) <sho19921005@gmail.com>  
GitHub User @tatsumack (4510569) <tatsu.mack@gmail.com>  
GitHub User @tell-k (26263) <ffk2005@gmail.com>  
GitHub User @tennashi (10219626) <tennashio@gmail.com>  
GitHub User @uhei (2116845) <uhei@users.noreply.github.com>  
GitHub User @uropek (39370426) <uropek@gmail.com>  
GitHub User @utkarsh-extc (53217283) <utkarsh.extc@gmail.com>  
GitHub User @witchard (4994659) <witchard@hotmail.co.uk>  
GitHub User @yah01 (12216890) <kagaminehuan@gmail.com>  
GitHub User @yuanhh (1298735) <yuan415030@gmail.com>  
GitHub User @zikaeroh (48577114) <zikaeroh@gmail.com>  
GitHub User @ZZMarquis (7624583) <zhonglingjian3821@163.com>  
Giulio Iotti <dullgiulio@gmail.com>  
Giulio Micheloni <giulio.micheloni@gmail.com>  
Giuseppe Valente <gvalente@arista.com>  
Gleb Stepanov <glebstepanov1992@gmail.com>  
Glenn  
Brown <glennb@google.com>  
Glenn Lewis <gmlewis@google.com>  
Gordon Klaus <gordon.klaus@gmail.com>  
Gordon Tyler <gordon@doxxx.net>  
Graham King <graham4king@gmail.com>  
Graham Miller <graham.miller@gmail.com>  
Grant Griffiths <ggp493@gmail.com>  
Greg Poirier <greg.istehbest@gmail.com>  
Greg Steuck <gnezdo+github@google.com>  
Greg Thelen <gthelen@google.com>  
Greg Ward <greg@gerg.ca>  
Grgoire Delattre <gregoire.delattre@gmail.com>  
Gregory Man <man.gregory@gmail.com>  
Gregory Petrosyan <gregory.petrosyan@gmail.com>  
Guilherme Caruso <gui.martinscaruso@gmail.com>  
Guilherme Garnier <guilherme.garnier@gmail.com>  
Guilherme Goncalves <guilhermeaugustosg@gmail.com>  
Guilherme Rezende <guilhermebr@gmail.com>  
Guillaume J. Charmes <guillaume@charmes.net>  
Gnter Noack <gnoack@google.com>  
Guobiao Mei <meiguobiao@gmail.com>  
Guoliang Wang <iamwgliang@gmail.com>  
Gustav Paul <gustav.paul@gmail.com>  
Gustav Westling <gustav@westling.xyz>  
Gustavo Franco <gustavorfranco@gmail.com>  
Gustavo Niemeyer <gustavo@niemeyer.net>

<n13m3y3r@gmail.com>  
Gwenael Treguier <gwenn.kahz@gmail.com>  
Gyu-Ho Lee <gyuhox@gmail.com>  
H. brahim Gngr <igungor@gmail.com>  
Hajime Hoshi <hajimehoshi@gmail.com>  
Hallgrimur Gunnarsson <halg@google.com>  
HAMANO Tsukasa <hamano@osstech.co.jp>  
Han-Wen Nienhuys <hanwen@google.com>  
Hang Qian <hangqian90@gmail.com>  
Hanjun Kim <hallazzang@gmail.com>  
Haosdent Huang <haosdent@gmail.com>  
Harald Nordgren <haraldnordgren@gmail.com>  
Hari haran <hariharan.uno@gmail.com>  
Hariharan Srinath <srinathh@gmail.com>  
Harley Laue <losinggeneration@gmail.com>  
Harry Moreno <morenoh149@gmail.com>  
Harshavardhana <hrshvardhana@gmail.com>  
Hasan Ozgan <hasan@ozgan.net>  
Hasit Bhatt <hasit.p.bhatt@gmail.com>  
Hauke Lffler <hloeffler@users.noreply.github.com>  
Hvard Haugen <havard.haugen@gmail.com>  
He Liu <liulonnie@gmail.com>  
Hector Chu <hectorchu@gmail.com>  
Hector Martin Cantero <hector@marcansoft.com>  
Henning Schmiedehausen <henning@schmiedehausen.org>  
Henrik Edwards <henrik.edwards@gmail.com>  
Henrik  
Hodne <henrik@hodne.io>  
Henry Adi Sumarto <henry.adisumarto@gmail.com>  
Henry Bubert <google@mindeco.de>  
Henry Chang <mr.changyuheng@gmail.com>  
Henry Clifford <h.a.clifford@gmail.com>  
Henry Wong <liushuai.wang@elastic.co>  
Herbert Georg Fischer <herbert.fischer@gmail.com>  
Herbie Ong <herbie@google.com>  
Heschi Kreinick <heschi@google.com>  
Hidetatsu Yaginuma <ygnmhdt@gmail.com>  
Hilko Bengen <bengen@hilluzination.de>  
Hiroaki Nakamura <hnakamur@gmail.com>  
Hiromichi Ema <ema.hiro@gmail.com>  
Hironao OTSUBO <motemen@gmail.com>  
Hiroshi Ioka <hirochachacha@gmail.com>  
Hitoshi Mitake <mitake.hitoshi@gmail.com>  
Holden Huang <ttyh061@gmail.com>  
Hong Ruiqi <hongruiqi@gmail.com>  
Hongfei Tan <feilengcui008@gmail.com>  
Horacio Duran <horacio.duran@gmail.com>  
Horst Rutter <hhrutter@gmail.com>

Hossein Sheikh Attar <hattar@google.com>  
Howard Zhang <howard.zhang@arm.com>  
Hsin Tsao <tsao@google.com>  
Hsin-Ho Yeh <yhh92u@gmail.com>  
Hu Keping <hukeping@huawei.com>  
Huan Du <i@huandu.me>  
Hugues Bruant <hugues.bruant@gmail.com>  
Huy  
Le <huy.dinh.le.89@gmail.com>  
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>  
Hyoyoung Chang <hyoyoung@gmail.com>  
Ian Cottrell <iancottrell@google.com>  
Ian Davis <nospam@iandavis.com>  
Ian Gudger <ian@loosescre.ws>  
Ian Haken <ihaken@netflix.com>  
Ian Kent <iankent85@gmail.com>  
Ian Lance Taylor <iant@golang.org>  
Ian Leue <ian@appboy.com>  
Ian Zapolsky <ianzapolsky@gmail.com>  
Ibrahim AshShohail <ibra.sho@gmail.com>  
Icarus Sparry <golang@icarus.freeuk.com>  
Iccha Sethi <icchasethi@gmail.com>  
Idora Shinatose <idora.shinatose@gmail.com>  
Ignacio Hagopian <jsign.uy@gmail.com>  
Igor Bernstein <igorbernstein@google.com>  
Igor Dolzhikov <bluesriverz@gmail.com>  
Igor Vashyst <ivashyst@gmail.com>  
Igor Zhilianin <igor.zhilianin@gmail.com>  
Ilya Yalovyy <yalovoy@gmail.com>  
Ilya Sinelnikov <sidhmangh@gmail.com>  
Ilya Tocar <ilya.tocar@intel.com>  
INADA Naoki <songofacandy@gmail.com>  
Inanc Gumus <m@inanc.io>  
Ingo Gottwald <in.gottwald@gmail.com>  
Ingo Krabbe <ikrabbe.ask@gmail.com>  
Ingo  
Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>  
Ioannis Georgoulas <geototti21@hotmail.com>  
Irbe Krumina <irbekrm@gmail.com>  
Irfan Sharif <irfanmahmoudsharif@gmail.com>  
Irieda Noboru <irieda@gmail.com>  
Isaac Ardis <isaac.ardis@gmail.com>  
Isaac Wagner <ibw@isaacwagner.me>  
Isfan Azhabil <isfanazhabil@gmail.com>  
Iskander Sharipov <iskander.sharipov@intel.com> <quasilyte@gmail.com>  
Issac Trotts <issactrotts@google.com>  
Ivan Babrou <ivan@cloudflare.com>  
Ivan Bertona <ivan.bertona@gmail.com>

Ivan Krasin <krasin@golang.org>  
Ivan Kutuzov <arbrix@gmail.com>  
Ivan Markin <sw@nogoegst.net>  
Ivan Moscoso <moscoso@gmail.com>  
Ivan Osadchiy <ivan.osadchii@gmail.com>  
Ivan Sharavuev <shpiwan@gmail.com>  
Ivan Trubach <mr.trubach@icloud.com>  
Ivan Ukhov <ivan.ukhov@gmail.com>  
Ivy Evans <ivy@ivyevans.net>  
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>  
Jaap Aarts <jaap.aarts1@gmail.com>  
Jack Britton <jackxbritton@gmail.com>  
Jack Lindamood <jlindamo@justin.tv>  
Jacob Baskin  
<jbaskin@google.com>  
Jacob Blain Christen <dweomer5@gmail.com>  
Jacob H. Haven <jacob@cloudflare.com>  
Jacob Hoffman-Andrews <github@hoffman-andrews.com>  
Jacob Walker <jacobwalker0814@gmail.com>  
Jae Kwon <jae@tendermint.com>  
Jake B <doogie1012@gmail.com>  
Jakob Borg <jakob@nym.se>  
Jakob Weisblat <jakobw@mit.edu>  
Jakub ajka <jcajka@redhat.com>  
Jakub Kaczmarzyk <jakubk@mit.edu>  
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>  
Jamal Carvalho <jamal.a.carvalho@gmail.com>  
James Aguilar <jaguilar@google.com>  
James Bardin <j.bardin@gmail.com>  
James Chacon <jchacon@google.com>  
James Clarke <jrtc27@jrtc27.com>  
James Cowgill <James.Cowgill@imgtec.com>  
James Craig Burley <james-github@burleyarch.com>  
James David Chalfant <james.chalfant@gmail.com>  
James Eady <jmeady@google.com>  
James Fysh <james.fysh@gmail.com>  
James Gray <james@james4k.com>  
James Hartig <fastest963@gmail.com>  
James Lawrence <jljatone@gmail.com>  
James Meneghello <rawrz0r@gmail.com>  
James Myers <jfmyers9@gmail.com>  
James Neve <jamesoneve@gmail.com>  
James  
Nugent <james@jen20.com>  
James P. Cooper <jamespcooper@gmail.com>  
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>  
James Schofield <james@shoeboxapp.com>  
James Smith <jrs1995@icloud.com>

James Sweet <james.sweet88@googlemail.com>  
James Toy <nil@opensesame.st>  
James Treanor <jtreanor3@gmail.com>  
James Tucker <raggi@google.com>  
James Whitehead <jnwhiteh@gmail.com>  
Jamie Beverly <jamie.r.beverly@gmail.com>  
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>  
Jamie Kerr <jkerr113@googlemail.com>  
Jamie Liu <jamieliu@google.com>  
Jamie Stackhouse <contin673@gmail.com>  
Jamie Turner <jamwt@dropbox.com>  
Jamie Wilkinson <jaq@spacepants.org>  
Jamil Djadala <djadala@gmail.com>  
Jan Berktold <jan@berktold.co>  
Jan H. Hosang <jan.hosang@gmail.com>  
Jan Kratochvil <jan.kratochvil@redhat.com>  
Jan Lehnardt <jan@apache.org>  
Jan Mercl <0xjnml@gmail.com> <befelemepeseveze@gmail.com>  
Jan Newmarch <jan.newmarch@gmail.com>  
Jan Pilzer <jan.pilzer@gmx.de>  
Jan Steinke <jan.steinke@gmail.com>  
Jan  
Ziak <0xe2.0x9a.0x9b@gmail.com>  
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>  
Jannis Andrija Schnitzer <jannis@schnitzer.im>  
Jared Allard <jaredallard@users.noreply.github.com>  
Jared Culp <jculp14@gmail.com>  
Jaroslavas Poepko <jp@webmaster.ms>  
Jason A. Donenfeld <Jason@zx2c4.com>  
Jason Baker <jason-baker@users.noreply.github.com>  
Jason Barnett <jason.w.barnett@gmail.com>  
Jason Buberel <jbuberel@google.com>  
Jason Chu <jasonchujc@gmail.com>  
Jason Del Ponte <delpontej@gmail.com>  
Jason Hall <jasonhall@google.com>  
Jason Keene <jasonkeene@gmail.com>  
Jason LeBrun <jblebrun@gmail.com>  
Jason Smale <jsmale@zendesk.com>  
Jason Travis <infomaniac7@gmail.com>  
Jason Wangsadinata <jwangsadinata@gmail.com>  
Javier Kohen <jkohen@google.com>  
Javier Revillas <jrevillas@massivedynamic.io>  
Javier Segura <javism@gmail.com>  
Jay Conrod <jayconrod@google.com>  
Jay Taylor <outtatime@gmail.com>  
Jay Weiskopf <jay@jayschwa.net>  
Jean de Klerk <deklerk@google.com>  
Jean-Andr Santoni

<jean.andre.santoni@gmail.com>  
Jean-Franois Bustarret <jf@bustarret.com>  
Jean-Francois Cantin <jfcantin@gmail.com>  
Jean-Marc Eurin <jmeurin@google.com>  
Jean-Nicolas Moal <jn.moal@gmail.com>  
Jed Denlea <jed@fastly.com>  
Jdrzej Szczepaniak <jbszczepaniak@gmail.com>  
Jeet Parekh <jeetparekh96@gmail.com>  
Jeevanandam M <jeeva@myjeeva.com>  
Jeff (Zhefu) Jiang <jeffjiang@google.com>  
Jeff Craig <jeffcraig@google.com>  
Jeff Dupont <jeff.dupont@gmail.com>  
Jeff Hodges <jeff@somethingsimilar.com>  
Jeff Johnson <jrjohnson@google.com>  
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>  
Jeff Sickel <jas@corpus-callosum.com>  
Jeff Wendling <jeff@spacemonkey.com>  
Jeffrey H <jeffreyh192@gmail.com>  
Jelte Fennema <github-tech@jeltef.nl>  
Jens Frederich <jfrederich@gmail.com>  
Jeremiah Harmsen <jeremiah@google.com>  
Jeremy Banks <\_@jeremy.ca>  
Jeremy Canady <jcanady@gmail.com>  
Jeremy Faller <jeremy@golang.org>  
Jeremy Jackins <jeremyjackins@gmail.com>  
Jeremy Jay <jeremy@pbnjay.com>  
Jeremy Schlatter <jeremy.schlatter@gmail.com>  
Jeroen  
Bobbeldijk <jrbob92@gmail.com>  
Jeroen Simonetti <jeroen@simonetti.nl>  
Jerrin Shaji George <jerrinsg@gmail.com>  
Jess Frazelle <me@jessfraz.com>  
Jesse Szwedko <jesse.szwedko@gmail.com>  
Jess Espino <jespinog@gmail.com>  
Jia Zhan <jzhan@uber.com>  
Jiacai Liu <jiacai2050@gmail.com>  
Jianing Yu <jnyu@google.com>  
Jianqiao Li <jianqiaoli@google.com>  
Jie Ma <jienius@outlook.com>  
Jihyun Yu <yjh0502@gmail.com>  
Jim Cote <jfcote87@gmail.com>  
Jim Kingdon <jim@bolt.me>  
Jim McGrath <jimmc2@gmail.com>  
Jim Minter <jminter@redhat.com>  
Jimmy Frasche <soapboxcicero@gmail.com>  
Jimmy Zelinskie <jimmyzelinskie@gmail.com>  
Jin-wook Jeong <jeweljar@hanmail.net>  
Jingcheng Zhang <diogin@gmail.com>

Jingguo Yao <yaojingguo@gmail.com>  
Jingnan Si <jingnan.si@gmail.com>  
Jinkun Zhang <franksnolf@gmail.com>  
Jiong Du <londevil@gmail.com>  
Jirka Dank <dnk@mail.muni.cz>  
Jiulong Wang <jiulongw@gmail.com>  
Joakim Sernbrant <serbaut@gmail.com>  
Joe Bowbeer <joe.bowbeer@gmail.com>  
Joe Cortopassi <joe@joecortopassi.com>  
Joe  
Farrell <joe2farrell@gmail.com>  
Joe Harrison <joehazzers@gmail.com>  
Joe Henke <joed.henke@gmail.com>  
Joe Kyo <xunianzu@gmail.com>  
Joe Poirier <jdpoirier@gmail.com>  
Joe Richey <joerichey@google.com>  
Joe Shaw <joe@joeshaw.org>  
Joe Sylve <joe.sylve@gmail.com>  
Joe Tsai <joetsai@digital-static.net>  
Joel Sing <joel@sing.id.au> <jsing@google.com>  
Jol Stemmer <jstemmer@google.com>  
Joel Stemmer <stemmertech@gmail.com>  
Joey Geiger <jgeiger@users.noreply.github.com>  
Johan Brandhorst <johan.brandhorst@gmail.com>  
Johan Euphrosine <propy@google.com>  
Johan Jansson <johan.jansson@iki.fi>  
Johan Sageryd <j@1616.se>  
John Asmuth <jasmuth@gmail.com>  
John Beisley <huin@google.com>  
John C Barstow <jbowtie@amathaine.com>  
John DeNero <denero@google.com>  
John Dethridge <jcd@golang.org>  
John Gibb <johngibb@gmail.com>  
John Gilik <john@jgilik.com>  
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>  
John Howard Palevich <jack.palevich@gmail.com>  
John Jeffery <jjeffery@sp.com.au>  
John Jenkins <twodopeshaggy@gmail.com>  
John  
Leidegren <john.leidegren@gmail.com>  
John McCabe <john@johnmccabe.net>  
John Moore <johnkenneth.moore@gmail.com>  
John Newlin <jnewlin@google.com>  
John Papandriopoulos <jpap.code@gmail.com>  
John Potocny <johnp@vividcortex.com>  
John R. Lenton <jlenton@gmail.com>  
John Schnake <schnake.john@gmail.com>  
John Shahid <jvshahid@gmail.com>



John Tuley <john@tuley.org>  
John Weldon <johnweldon4@gmail.com>  
Johnny Luo <johnnyluo1980@gmail.com>  
Jon Chen <jchen@justin.tv>  
Jon Johnson <jonjohnson@google.com>  
Jonas Bernoulli <jonas@bernoul.li>  
Jonathan Allie <jonallie@google.com>  
Jonathan Amsterdam <jba@google.com>  
Jonathan Boulle <jonathanboulle@gmail.com>  
Jonathan Chen <dijonkitchen@users.noreply.github.com>  
Jonathan Feinberg <feinberg@google.com>  
Jonathan Gold <jgold.bg@gmail.com>  
Jonathan Hseu <jhseu@google.com>  
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>  
Jonathan Nieder <jrn@google.com>  
Jonathan Pentecost <pentecostjonathan@gmail.com>  
Jonathan Pittman <jmpittman@google.com>  
<jonathan.mark.pittman@gmail.com>  
Jonathan Rudenberg <jonathan@titanous.com>  
Jonathan Stacks <jonstacks13@gmail.com>  
Jonathan Wills <runningwild@gmail.com>  
Jonathon Lacher <jonathon.lacher@gmail.com>  
Jongmin Kim <atomaths@gmail.com>  
Joonas Kuorilehto <joneskoo@derbian.fi>  
Joop Kieft <ikojba@gmail.com> <joop@kiefte.net>  
Jordan Christiansen <xordspar0@gmail.com>  
Jordan Krage <jmank88@gmail.com>  
Jordan Lewis <jordanthelewis@gmail.com>  
Jordan Liggitt <liggitt@google.com>  
Jordan Rhee <jordanrh@microsoft.com>  
Jordi Martin <jordimartin@gmail.com>  
Jorge Araya <jorgejavieran@yahoo.com.mx>  
Jorge L. Fatta <jorge.fatta@auth0.com>  
Jos Visser <josv@google.com>  
Josa Gesell <josa@gesell.me>  
Jose Luis Vzquez Gonzlez <josvazg@gmail.com>  
Joseph Bonneau <jcb@google.com>  
Joseph Holsten <joseph@josephholsten.com>  
Josh Baum <joshbaum@google.com>  
Josh Bleecher Snyder <josharian@gmail.com>  
Josh Chorlton <jchorlton@gmail.com>  
Josh Deprez <josh.deprez@gmail.com>  
Josh Goebel <dreamer3@gmail.com>  
Josh Hoak  
<jhoak@google.com>  
Josh Holland <jrh@joshh.co.uk>  
Josh Roppo <joshroppo@gmail.com>  
Josh Varga <josh.varga@gmail.com>

Joshua Bezaleel Abednego <joshua.bezaleel@gmail.com>  
Joshua Boelter <joshua.boelter@intel.com>  
Joshua Chase <jcjosuachase@gmail.com>  
Joshua Crowgey <jcrowgey@uw.edu>  
Joshua M. Clulow <josh.clulow@joyent.com>  
Joshua Rubin <joshua@rubixconsulting.com>  
Josselin Costanzi <josselin@costanzi.fr>  
Jostein Stuhaug <js@solidsystem.no>  
JP Sugarbroad <jpsugar@google.com>  
JT Olds <jtolds@xnet5.com>  
JT Olio <hello@jtolio.com>  
Juan Carlos <juanjcsr@gmail.com>  
Juan Pablo Civile <elementohb@gmail.com>  
Jude Pereira <judebpereira@gmail.com>  
Jukka-Pekka Kekkonen <karatepekka@gmail.com>  
Julia Hansbrough <flowerhack@google.com>  
Julian Kornberger <jk+github@digineo.de>  
Julian Pastarmov <pastarmovj@google.com>  
Julian Phillips <julian@quantumfyre.co.uk>  
Julian Tibble <julian.tibble@gmail.com>  
Julie Qiu <julie@golang.org>  
Julien Kauffmann <julien.kauffmann@freelan.org>  
Julien Salleyron <julien.salleyron@gmail.com>  
Julien  
Schmidt <google@julienschmidt.com>  
Julio Montes <julio.montes@intel.com>  
Jun Zhang <jim.zoumo@gmail.com>  
Junda Liu <junda@celer.network>  
Jungho Ahn <jhahn@google.com>  
Junya Hayashi <ledmonster@gmail.com>  
Juraj Sukop <sukop@users.noreply.github.com>  
Jure Ham <jure.ham@zemanta.com>  
Justin Gracenin <jgracenin@gmail.com>  
Justin Li <git@justinli.net>  
Justin Nu <nuss.justin@gmail.com>  
Justyn Temme <justyntemme@gmail.com>  
Kai Backman <kaib@golang.org>  
Kai Dong <dokia2357@gmail.com>  
Kai Trukenmller <ktye78@gmail.com>  
Kale Blankenship <kale@lemnisis.com>  
Kaleb Elwert <kelwert@atlassian.com>  
Kalman Bekesi <kalmanb@google.com>  
Kamal Aboul-Hosn <aboulhosn@google.com>  
Kamil Chmielewski <kamil.chm@gmail.com>  
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>  
Kamil Rytarowski <krytarowski@users.noreply.github.com>  
Kang Hu <hukangustc@gmail.com>  
Kanta Ebihara <kantaebihara@gmail.com>

Karan Dhiman <karandhi@ca.ibm.com>  
Karel Pazdera <pazderak@gmail.com>  
Karoly  
Negyesi <chx1975@gmail.com>  
Karsten Khler <karsten.koehler95@gmail.com>  
Karthik Nayak <karthik.188@gmail.com>  
Kashav Madan <kshvmdn@gmail.com>  
Kate Manson <kate.manson@izettle.com>  
Katharine Berry <ktbry@google.com>  
Katie Hockman <katie@golang.org>  
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>  
Katrina Owen <katrina.owen@gmail.com>  
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>  
Kay Zhu <kayzhu@google.com>  
Kazuhiro Sera <seratch@gmail.com>  
KB Sriram <kbsriram@google.com>  
Keegan Carruthers-Smith <keegan.csmith@gmail.com>  
Kei Son <hey.calmdown@gmail.com>  
Keiji Yoshida <keijiyoshida.mail@gmail.com>  
Keisuke Kishimoto <keisuke.kishimoto@gmail.com>  
Keith Ball <inflatablewoman@gmail.com>  
Keith Randall <khr@golang.org>  
Keith Rarick <kr@xph.us>  
Kelly Heller <pestophagous@gmail.com>  
Kelsey Hightower <kelsey.hightower@gmail.com>  
Kelvin Foo Chuan Lyi <vmirage@gmail.com>  
Ken Friedenbach <kenliz@cruzio.com>  
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>  
Ken Sedgwick <ken@bonsai.com>  
Ken Thompson <ken@golang.org>  
Kenichi  
Tsunokawa <kenichi.tsunokawa@gmail.com>  
Kenji Kaneda <kenji.kaneda@gmail.com>  
Kenji Yano <kenji.yano@gmail.com>  
Kenneth Shaw <kenshaw@gmail.com>  
Kenny Grant <kennygrant@gmail.com>  
Kenta Mori <zoncoen@gmail.com>  
Kerollos Magdy <kerolloz@yahoo.com>  
Ketan Parmar <ketanbparmar@gmail.com>  
Kevan Swanberg <kevswanberg@gmail.com>  
Kevin Ballard <kevin@sb.org>  
Kevin Burke <kev@inburke.com>  
Kvin Dunglas <dunglas@gmail.com>  
Kevin Gillette <extemporalgenome@gmail.com>  
Kevin Kirsche <kev.kirsche@gmail.com>  
Kevin Klues <klueska@gmail.com> <klueska@google.com>  
Kevin Malachowski <chowski@google.com>  
Kevin Ruffin <kruffin@gmail.com>

Kevin Vu <kevin.m.vu@gmail.com>  
Kevin Zita <bleedgreenandgold@gmail.com>  
Keyan Pishdadian <kpishdadian@gmail.com>  
Kezhu Wang <kezhuw@gmail.com>  
Khosrow Moossavi <khos2ow@gmail.com>  
Kieran Colford <kieran@kcolford.com>  
Kim Shrier <kshrier@racktopsystems.com>  
Kim Yongbin <kybinz@gmail.com>  
Kir Kolyshkin <kolyshkin@gmail.com>  
Kirill Korotaev <kirillx@gmail.com>  
Kirill  
Motkov <Motkov.Kirill@gmail.com>  
Kirill Smelkov <kirr@nexedi.com>  
Kirill Tatchihin <kirabsuir@gmail.com>  
Kirk Han <kirk91.han@gmail.com>  
Kirklin McDonald <kirklin.mcdonald@gmail.com>  
Klaus Post <klauspost@gmail.com>  
Kodie Goodwin <kodiegoodwin@gmail.com>  
Koichi Shiraishi <zchee.io@gmail.com>  
Koki Ide <niconegoto@yahoo.co.jp>  
Koki Tomoshige <tomocy.dev@gmail.com>  
Komu Wairagu <komuw05@gmail.com>  
Konstantin <konstantin8105@gmail.com>  
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>  
Koya IWAMURA <kiwamura0314@gmail.com>  
Kris Kwiatkowski <kris@cloudflare.com>  
Kris Nova <kris@nivenly.com>  
Kris Rousey <krousey@google.com>  
Kristopher Watts <traetox@gmail.com>  
Kshitij Saraogi <kshitijgaraogi@gmail.com>  
Kun Li <likunarmstrong@gmail.com>  
Kunpei Sakai <namusyaka@gmail.com>  
Kuntal Majumder <hellozee@disroot.org>  
Kush Patel <kush.patel@hootsuite.com>  
Kyle Consalus <consalus@gmail.com>  
Kyle Isom <kyle@gokyle.net>  
Kyle Jones <kyle@kyledj.com>  
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>  
Kyle  
Nusbaum <kyle@datadog.com>  
Kyle Shannon <kyle@pobox.com>  
Kyle Spiers <eiais@google.com>  
Kyle Wood <kyle@kylewood.cc>  
Kyohei Kadota <lufia@lufia.org>  
Kyrylo Silin <silin@kyrylo.org>  
L Campbell <unpantsu@gmail.com>  
Lai Jiangshan <eag0628@gmail.com>  
Lajos Papp <lalyos@yahoo.com>

Lakshay Garg <lakshay.garg.1996@gmail.com>  
Lann Martin <lanm@google.com>  
Lanre Adelowo <yo@lanre.wtf>  
Larry Clapp <larry@theclapp.org>  
Larry Hosken <lahosken@golang.org>  
Lars Jeppesen <jeppesen.lars@gmail.com>  
Lars Lehtonen <lars.lehtonen@gmail.com>  
Lars Wiegman <lars@namsral.com>  
Larz Conwell <larzconwell@gmail.com>  
Laurent Voisin <lpvoisin@gmail.com>  
Laurie Clark-Michalek <laurie@qubit.com>  
LE Manh Cuong <cuong.manhle.vn@gmail.com>  
Lee Hinman <hinman@gmail.com>  
Lee Packham <lpackham@gmail.com>  
Lehner Florian <dev@der-flo.net>  
Leigh McCulloch <leighmcc@gmail.com>  
Leo Antunes <leo@costela.net>  
Leo Rudberg <ljr@google.com>  
Leon Klingele <git@leonklingele.de>  
Leonardo Comelli <leonardo.comelli@gmail.com>  
Leonel  
Quinteros <leonel.quinteros@gmail.com>  
Lev Shamardin <shamardin@gmail.com>  
Lewin Bormann <lewin.bormann@gmail.com>  
Liam Haworth <liam@haworth.id.au>  
Lily Chung <lilithkchung@gmail.com>  
Lion Yang <lion@aosc.xyz>  
Liz Rice <liz@lizrice.com>  
Lloyd Dewolf <foolswisdom@gmail.com>  
Lorenz Bauer <lmb@cloudflare.com>  
Lorenz Brun <lorenz@brun.one>  
Lorenz Nickel <mail@lorenznickel.de>  
Lorenzo Masini <rugginoso@develer.com>  
Lorenzo Stoakes <lstoakes@gmail.com>  
Louis Kruger <louisk@google.com>  
Luan Santos <cfcluan@gmail.com>  
Lubomir I. Ivanov <neolit123@gmail.com>  
Luca Bruno <luca.bruno@coreos.com>  
Luca Greco <luca.greco@alcacoop.it>  
Lucas Bremgartner <lucas.bremgartner@gmail.com>  
Lucas Clemente <lclemente@google.com>  
Lucien Stuker <lucien.stuker@gmail.com>  
Lucio De Re <lucio.dere@gmail.com>  
Ludi Rehak <ludi317@gmail.com>  
Luigi Riefolo <luigi.riefolo@gmail.com>  
Luit van Drongelen <luitvd@gmail.com>  
Luka Zakrajek <tr00.g33k@gmail.com>  
Luka Zitnik <luka.zitnik@gmail.com>

Lukasz Milewski <lmilewski@gmail.com>  
Luke  
Champine <luke.champine@gmail.com>  
Luke Curley <qpingu@gmail.com>  
Luke Granger-Brown <git@lukegb.com>  
Luke Young <bored-engineer@users.noreply.github.com>  
Luna Duclos <luna.duclos@palmstonegames.com>  
Luuk van Dijk <lvd@golang.org> <lvd@google.com>  
Lyle Franklin <lylejfranklin@gmail.com>  
Lynn Boger <laboger@linux.vnet.ibm.com>  
Ma Peiqi <mapeiqi2017@gmail.com>  
Maarten Bezemer <maarten.bezemer@gmail.com>  
Maciej Dbski <maciejd@google.com>  
Madhu Rajanna <madhupr007@gmail.com>  
Magnus Hiie <magnus.hiie@gmail.com>  
Maicon Costa <maiconscosta@gmail.com>  
Mak Kolybabi <mak@kolybabi.com>  
Maksym Trykur <maksym.trykur@gmail.com>  
Mal Curtis <mal@mal.co.nz>  
Manfred Touron <m@42.am>  
Manigandan Dharmalingam <manigandan.jeff@gmail.com>  
Manish Goregaokar <manishsmail@gmail.com>  
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>  
Mansour Rahimi <rahimi.mnr@gmail.com>  
Manu Garg <manugarg@google.com>  
Manu S Ajith <neo@codingarena.in>  
Manuel Mendez <mmendez534@gmail.com>  
Marat  
Khabibullin <marat.khabibullin@jetbrains.com>  
Marc Sanmiquel <marcsanmiquel@gmail.com>  
Marc Weistroff <marc@weistroff.net>  
Marc-Antoine Ruel <maruel@chromium.org>  
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>  
Marcel van Lohuizen <mpvl@golang.org>  
Marcelo Cantos <marcelo.cantos@gmail.com>  
Marcelo E. Magallon <marcelo.magallon@gmail.com>  
Marco Hennings <marco.hennings@freiheit.com>  
Marcus Weiner <marcus.weiner@gmail.com>  
Marcus Willock <crazcalm@gmail.com>  
Marga Manterola <marga@google.com>  
Mariano Cano <mariano@smallstep.com>  
Marin Bai <marin.basic02@gmail.com>  
Mario Arranz <marioarranzr@gmail.com>  
Marius A. Eriksen <marius@grailbio.com>  
Marius Nuennerich <mnu@google.com>  
Mark Adams <mark@markadams.me>  
Mark Bucciarelli <mkbucc@gmail.com>  
Mark Glines <mark@glines.org>

Mark Harrison <marhar@google.com>  
Mark Percival <m@mdp.im>  
Mark Pulford <mark@kyne.com.au>  
Mark Rushakoff <mark.rushakoff@gmail.com>  
Mark Ryan <mark.d.ryan@intel.com>  
Mark Severson <miquella@gmail.com>  
Mark Theunissen  
<mark.theunissen@gmail.com>  
Mark Villacampa <m@markvillacampa.com>  
Mark Wolfe <mark@wolfe.id.au>  
Mark Zavislak <zavislak@google.com>  
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>  
Marko Kevac <marko@kevac.org>  
Marko Kungla <marko.kungla@gmail.com>  
Marko Mikulicic <mkm@google.com>  
Marko Mudrinic <mudrinic.mare@gmail.com>  
Marko Tiikkaja <marko@joh.to>  
Markus Duft <markus.duft@salomon.at>  
Markus Sonderegger <marraison@gmail.com>  
Markus Zimmermann <zimmski@gmail.com>  
Marten Seemann <martenseemann@gmail.com>  
Martin Asquino <martin.asquino@gmail.com>  
Martin Bertschler <mbertschler@gmail.com>  
Martin Garton <garton@gmail.com>  
Martin Habbecke <marhab@google.com>  
Martin Hamrle <martin.hamrle@gmail.com>  
Martin Hoefling <martin.hoefling@gmx.de>  
Martin Kreichgauer <martinkr@google.com>  
Martin Kunc <martinkunc@users.noreply.github.com>  
Martin Lindhe <martin.j.lindhe@gmail.com>  
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>  
Martin Neubauer <m.ne@gmx.net>  
Martin Olsen <github.com@martinolsen.net>  
Martin  
Olsson <martin@minimum.se>  
Martin Probst <martin@probst.io>  
Martin Sucha <anty.sk+git@gmail.com>  
Martin Tournoij <martin@arp242.net>  
Martins Sipenko <martins.sipenko@gmail.com>  
Martynas Budrinas <mabu@google.com>  
Marvin Stenger <marvin.stenger94@gmail.com>  
Marwan Sulaiman <marwan.sulaiman@work.co>  
Maryan Hratson <gmarik@gmail.com>  
Masahiro Furudate <masahiro.furudate@gmail.com>  
Masahiro Wakame <vvakame@gmail.com>  
Masaki Yoshida <yoshida.masaki@gmail.com>  
Masaya Watanabe <sfbgwm30@gmail.com>  
Mat Byczkowski <mbyczkowski@gmail.com>

Mat Ryer <thatmatryer@gmail.com>  
Mt Gulys <mgulyas86@gmail.com>  
Matej Bao <matejbaco@gmail.com>  
Mateus Amin <mateus.amin@gmail.com>  
Mateusz Czapliski <czapkofan@gmail.com>  
Mathias Beke <git@denbeke.be>  
Mathias Hall-Andersen <mathias@hall-andersen.dk>  
Mathias Leppich <mleppich@muhqu.de>  
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>  
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>  
Matt Aimonetti <mattaimonetti@gmail.com>  
Matt Blair  
<me@matthewblair.net>  
Matt Bostock <matt@mattbostock.com>  
Matt Brown <mbrown@google.com>  
Matt Dee <mdee@hioscar.com>  
Matt Drollette <matt@drollette.com>  
Matt Harden <matt.harden@gmail.com>  
Matt Jibson <matt.jibson@gmail.com>  
Matt Joiner <anacrolix@gmail.com>  
Matt Jones <mrjones@google.com>  
Matt Juran <thepciet@gmail.com>  
Matt Layher <mdllyher@gmail.com>  
Matt Reiferson <mreiferson@gmail.com>  
Matt Robenolt <matt@ydekproductions.com>  
Matt Strong <mstrong1341@gmail.com>  
Matt T. Proud <matt.proud@gmail.com>  
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>  
Matthew Brennan <matty.brennan@gmail.com>  
Matthew Broberg <matthewbbroberg@gmail.com>  
Matthew Cottingham <mattcottingham@gmail.com>  
Matthew Dempsky <mdempsky@google.com>  
Matthew Denton <mdenton@skyportsystems.com>  
Matthew Holt <Matthew.Holt+git@gmail.com>  
Matthew Horsnell <matthew.horsnell@gmail.com>  
Matthew Waters <mwwaters@gmail.com>  
Matthieu Hauglustaine <matt.hauglustaine@gmail.com>  
Matthieu Olivier <olivier.matthieu@gmail.com>  
Matthijs  
Kooijman <matthijs@stdin.nl>  
Max Riveiro <kavu13@gmail.com>  
Max Schmitt <max@schmitt.mx>  
Max Semenik <maxsem.wiki@gmail.com>  
Max Ushakov <ushmax@gmail.com>  
Maxim Eryomenko <moeryomenko@gmail.com>  
Maxim Khitrov <max@mxcrypt.com>  
Maxim Pimenov <mpimenov@google.com>  
Maxim Pugachev <pugachev.mm@gmail.com>



Maxim Ushakov <ushakov@google.com>  
Maxime de Roucy <maxime.deroucy@gmail.com>  
Mximo Cuadros Ortiz <mcuadros@gmail.com>  
Maxwell Krohn <themax@gmail.com>  
Maya Rashish <maya@NetBSD.org>  
Mayank Kumar <krmayankk@gmail.com>  
Meir Fischer <meirfischer@gmail.com>  
Meng Zhuo <mengzhuo1203@gmail.com> <mzh@golangcn.org>  
Mhd Sulhan <m.shulhan@gmail.com>  
Micah Stetson <micah.stetson@gmail.com>  
Michael Anthony Knyszek <mknyszek@google.com>  
Michael Brandenburg <mbrandenburg@bolste.com>  
Michael Chaten <mchaten@gmail.com>  
Michael Cook <code@mdcook.net>  
Michael Darakananda <pongad@google.com>  
Michael Dorner <mail@michaeldorf.de>  
Michael Edwards <medwards@walledcity.ca>  
Michael Elkins <michael.elkins@gmail.com>  
Michael  
Ellis <micellis@justin.tv>  
Michael Fraenkel <michael.fraenkel@gmail.com>  
Michael Fromberger <michael.j.fromberger@gmail.com>  
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>  
Michael Henderson <mdhender@users.noreply.github.com>  
Michael Hendricks <michael@ndrix.org>  
Michael Hoisie <hoisie@gmail.com>  
Michael Hudson-Doyle <michael.hudson@linaro.org>  
Michael Kasch <michael.kasch@gmail.com>  
Michael Kufl <golang@c.michael-kaeufl.de>  
Michael Kelly <mjk@google.com>  
Michael Lewis <mikelikespie@gmail.com>  
Michael MacInnis <Michael.P.MacInnis@gmail.com>  
Michael Marineau <michael.marineau@coreos.com>  
Michael Matloob <matloob@google.com>  
Michael McConville <momconville@gmail.com>  
Michael McGreevy <mcgreevy@golang.org>  
Michael McLoughlin <mmcloughlin@gmail.com>  
Michael Munday <mike.munday@ibm.com>  
Michael Pearson <mipearson@gmail.com>  
Michael Piatek <piatek@google.com>  
Michael Pratt <mpratt@google.com>  
Michael Schaller <michael@5challer.de>  
Michael Schurter <michael.schurter@gmail.com>  
Michael  
Shields <mshields@google.com>  
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>  
Michael Steinert <mike.steinert@gmail.com>  
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>

Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>  
Michael Traver <mtraver@google.com>  
Michael Vetter <g.bluehut@gmail.com>  
Michael Vogt <mvo@ubuntu.com>  
Michal Bohuslvek <mbohuslvek@gmail.com>  
Michal Cierniak <cierniak@google.com>  
Micha Derkacz <ziutek@inet.pl>  
Michal Franc <lam.michal.franc@gmail.com>  
Micha owicki <mlowicki@gmail.com>  
Michal Pristas <michal.pristas@gmail.com>  
Michal Rostecki <mrostecki@suse.de>  
Michalis Kargakis <michaliskargakis@gmail.com>  
Michel Lespinasse <>walken@google.com>  
Mickael Kerjean <mickael.kerjean@gmail.com>  
Mickey Reiss <mickeyreiss@gmail.com>  
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>  
Miguel Acero <acero@google.com>  
Miguel Mendez <stxmendez@gmail.com>  
Miguel Molina <hi@mvader.me>  
Mihai Borobocea  
<MihaiBorobocea@gmail.com>  
Mihai Moldovan <ionic@ionic.de>  
Mihai Todor <todormihai@gmail.com>  
Mihail Minaev <minaev.mike@gmail.com>  
Mikael Tillenius <mikti42@gmail.com>  
Mike Andrews <mra@xoba.com>  
Mike Appleby <mike@app.leby.org>  
Mike Danese <mikedanese@google.com>  
Mike Houston <mike@kothar.net>  
Mike Kabischev <kabischev@gmail.com>  
Mike Rosset <mike.rosset@gmail.com>  
Mike Samuel <mikesamuel@gmail.com>  
Mike Solomon <msolo@gmail.com>  
Mike Strosaker <strosake@us.ibm.com>  
Mike Tsao <mike@sowbug.com>  
Mike Wiacek <mjwiacek@google.com>  
Mikhail Fesenko <proggga@gmail.com>  
Mikhail Gusarov <dottedmag@dottedmag.net>  
Mikhail Panchenko <m@mihasya.com>  
Miki Tebeka <miki.tebeka@gmail.com>  
Mikio Hara <mikioh.mikioh@gmail.com>  
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>  
Mikoaj Baranowski <mikolajb@gmail.com>  
Milan Knezevic <milan.knezevic@mips.com>  
Milan Patel <bicelot3@gmail.com>  
Milutin Jovanovic <jovanovic.milutin@gmail.com>  
MinJae Kwon <mingrammer@gmail.com>  
Miquel Sabat Sol <mikisabate@gmail.com>

Mirko  
Hansen <baaazen@gmail.com>  
Miroslav Genov <mgenov@gmail.com>  
Misty De Meo <mistydemeo@gmail.com>  
Mohit Agarwal <mohit@sdf.org>  
Mohit kumar Bajoria <mohitbajo36@gmail.com>  
Mohit Verma <vmohit.93@gmail.com>  
Momchil Velikov <momchil.velikov@gmail.com>  
Monis Khan <mkhan@redhat.com>  
Monty Taylor <mordred@inaugust.com>  
Moritz Fain <moritz@fain.io>  
Moriyoshi Koizumi <mozo@mozo.jp>  
Morten Siebuhr <sbhr@sbhr.dk>  
Mshe van der Sterre <moshevds@gmail.com>  
Mostyn Bramley-Moore <mostyn@antipode.se>  
Mrunal Patel <mrunalp@gmail.com>  
Muhammad Falak R Wani <falakreyaz@gmail.com>  
Muhammed Uluyol <uluyol0@gmail.com>  
Muir Manders <muir@mnd.rs>  
Mukesh Sharma <sharma.mukesh439@gmail.com>  
Mura Li <mura\_li@castech.com.tw>  
Mykhailo Lesyk <mikhail@lesyk.org>  
Naman Aggarwal <aggarwal.nam@gmail.com>  
Nan Deng <monnand@gmail.com>  
Nao Yonashiro <owan.orisano@gmail.com>  
Naoki Kanatani <k12naoki@gmail.com>  
Nate Wilkinson <nathanwilk7@gmail.com>  
Nathan Cantelmo <n.cantelmo@gmail.com>  
Nathan Caza <mastercactapus@gmail.com>  
Nathan  
Dias <nathan.dias@orijtech.com>  
Nathan Fiscaletti <nathan.fiscaletti@vrazo.com>  
Nathan Humphreys <nkhumphreys@gmail.com>  
Nathan John Youngman <nj@nathany.com>  
Nathan Otterness <otterness@cs.unc.edu>  
Nathan P Finch <nate.finch@gmail.com>  
Nathan VanBenschoten <nvanbenschoten@gmail.com>  
Nathan Youngman <git@nathany.com>  
Nathan(yinian) Hu <nathanhu@google.com>  
Nathaniel Cook <nvcook42@gmail.com>  
Naveen Kumar Sangi <naveenkumarsangi@protonmail.com>  
Neeilan Selvalingam <neeilan96@gmail.com>  
Neelesh Chandola <neelesh.c98@gmail.com>  
Neil Lyons <nwjlyons@googlemail.com>  
Neuman Vong <neuman.vong@gmail.com>  
Neven Sajko <nsajko@gmail.com>  
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>  
Niall Sheridan <nsheridan@gmail.com>

Nic Day <nic.day@me.com>  
Nicholas Katsaros <nick@nickkatsaros.com>  
Nicholas Maniscalco <nicholas@maniscalco.com>  
Nicholas Ng <nickng@nickng.io>  
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>  
Nicholas Sullivan <nicholas.sullivan@gmail.com>  
Nicholas  
Waples <nwaples@gmail.com>  
Nick Anthony <Liberatys@outlook.com>  
Nick Cooper <nmvc@google.com>  
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>  
Nick Harper <nharper@google.com>  
Nick Kubala <nkubala@google.com>  
Nick Leli <nicholasleli@gmail.com>  
Nick Miyake <nmiyake@users.noreply.github.com>  
Nick Patavalis <nick.patavalis@gmail.com>  
Nick Petroni <npetroni@cs.umd.edu>  
Nick Robinson <nrobinson13@gmail.com>  
Nick Smolin <nick27surgut@gmail.com>  
Nicolas BRULEZ <n.brulez@gmail.com>  
Nicolas Kaiser <nikai@nikai.net>  
Nicolas Owens <mischief@offblast.org>  
Nicolas S. Dade <nic.dade@gmail.com>  
Niek Sanders <niek.sanders@gmail.com>  
Niels Widger <niels.widger@gmail.com>  
Nigel Kerr <nigel.kerr@gmail.com>  
Nigel Tao <nigeltao@golang.org>  
Nik Nyby <nnyby@columbia.edu>  
Nikhil Benesch <nikhil.benesch@gmail.com>  
Nikita Gillmann <nikita@n0.is> <ng0@n0.is>  
Nikita Kryuchkov <nkryuchkov10@gmail.com>  
Nikita Vanyasin <nikita.vanyasin@gmail.com>  
Niklas Schnelle <niklas.schnelle@gmail.com>  
Niko Dziemba  
<niko@dziemba.com>  
Nikolay Turpitko <nikolay@turpitko.com>  
Nikson Kanti Paul <nikson.sust@gmail.com>  
Nils Larsgrd <nilsmagnus@gmail.com>  
Nir Soffer <nirsof@gmail.com>  
Niranjan Godbole <niranjan8192@gmail.com>  
Nishanth Shanmugham <nishanth.gerrard@gmail.com>  
Noah Campbell <noahcampbell@gmail.com>  
Noah Goldman <noahg34@gmail.com>  
Noble Johnson <noblepoly@gmail.com>  
Nodir Turakulov <nodir@google.com>  
Noel Georgi <git@frezbo.com>  
Norberto Lopes <nlopes.ml@gmail.com>  
Norman B. Lancaster <qbradq@gmail.com>

Nuno Cruces <ncruces@users.noreply.github.com>  
Obeyda Djefal <djefobey@gmail.com>  
Odin Ugedal <odin@ugedal.com>  
Oleg Bulatov <dimage@yandex-team.ru>  
Oleg Vakheta <helginet@gmail.com>  
Oleku Konko <oleku.konko@gmail.com>  
Oling Cat <olingcat@gmail.com>  
Oliver Hookins <ohookins@gmail.com>  
Oliver Powell <oliverpowell84@gmail.com>  
Oliver Stenbom <ostenbom@pivotal.io>  
Oliver Tonnhofer <olt@bogosoftware.com>  
Olivier Antoine <olivier.antoine@gmail.com>  
Olivier Duperray <duperray.olivier@gmail.com>  
Olivier  
Poitrey <rs@dailymotion.com>  
Olivier Saingre <osaingre@gmail.com>  
Omar Jarjur <ojarjur@google.com>  
Oryan Moshe <iamoryanmoshe@gmail.com>  
Osamu TONOMORI <osamingo@gmail.com>  
zgr Kesim <oec-go@kesim.org>  
Pablo Caderno <kaderno@gmail.com>  
Pablo Lalloni <plalloni@gmail.com>  
Pablo Rozas Larraondo <pablo.larraondo@anu.edu.au>  
Pablo Santiago Blum de Aguiar <scorplus@gmail.com>  
Padraig Kitterick <padraigkitterick@gmail.com>  
Pallat Anchaleechamaikorn <yod.pallat@gmail.com>  
Panos Georgiadis <pgeorgiadis@suse.de>  
Pantelis Sampaziotis <psampaz@gmail.com>  
Paolo Giarrusso <p.giarrusso@gmail.com>  
Paolo Martini <mrtnpaolo@gmail.com>  
Parker Moore <parkrmoore@gmail.com>  
Parminder Singh <parmsingh101@gmail.com>  
Pascal Dierich <pascal@pascaldierich.com>  
Pascal S. de Kloe <pascal@quies.net>  
Paschalis Tsilias <paschalis.tsilias@gmail.com>  
Pasi Thkp <pasi.tahkapaa@gmail.com>  
Pat Moroney <pat@pat.email>  
Patrick Barker <barkerp@vmware.com>  
Patrick Crosby <patrick@stathat.com>  
Patrick Gavlin <pgavlin@gmail.com>  
Patrick  
Higgins <patrick.allen.higgins@gmail.com>  
Patrick Lee <pattyshack101@gmail.com>  
Patrick Mzard <patrick@mezard.eu>  
Patrick Mylund Nielsen <patrick@patrickmn.com>  
Patrick Pelletier <pp.pelletier@gmail.com>  
Patrick Riley <pfr@google.com>  
Patrick Smith <pat42smith@gmail.com>

Patrik Lundin <patrik@sigterm.se>  
Paul A Querna <paul.querna@gmail.com>  
Paul Borman <borman@google.com>  
Paul Boyd <boyd.paul2@gmail.com>  
Paul Chang <paulchang@google.com>  
Paul D. Weber <x0bdev@gmail.com>  
Paul Hammond <paul@paulhammond.org>  
Paul Hankin <paulhankin@google.com>  
Paul Jolly <paul@myitcv.org.uk>  
Paul Lalonde <paul.a.lalonde@gmail.com>  
Paul M Furley <paul@paulfurley.com>  
Paul Marks <pmarks@google.com>  
Paul Meyer <paul.meyer@microsoft.com>  
Paul Nasrat <pnasrat@google.com>  
Paul PISCUC <paul.piscuc@gmail.com>  
Paul Querna <pquerna@apache.org>  
Paul Rosania <paul.rosania@gmail.com>  
Paul Ruest <pruest@gmail.com>  
Paul Sbarra <Sbarra.Paul@gmail.com>  
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>  
Paul  
Tyng <paul@paultyng.net>  
Paul van Brouwershaven <paul@vanbrouwershaven.com>  
Paul Wankadia <junyer@google.com>  
Paulo Casaretto <pcasaretto@gmail.com>  
Paulo Flabiano Smorigo <pfsmorigo@linux.vnet.ibm.com>  
Paulo Gomes <paulo.gomes.uk@gmail.com>  
Pavel Paulau <pavel.paulau@gmail.com>  
Pavel Zinovkin <pavel.zinovkin@gmail.com>  
Pavlo Sumkin <ymkins@gmail.com>  
Pawel Knap <pawelknap88@gmail.com>  
Pawel Szczur <filemon@google.com>  
Pei Xian Chee <luciolas1991@gmail.com>  
Percy Wegmann <ox.to.a.cart@gmail.com>  
Perry Abbott <perry.j.abbott@gmail.com>  
Petar Dambovaliev <petar.atanasov.1987@gmail.com>  
Petar Maymounkov <petarm@gmail.com>  
Peter Armitage <peter.armitage@gmail.com>  
Peter Bourgon <peter@bourgon.org>  
Peter Collingbourne <pcc@google.com>  
Peter Conerly <pconerly@gmail.com>  
Peter Dotchev <dotchev@gmail.com>  
Peter Froehlich <peter.hans.froehlich@gmail.com>  
Peter Gonda <pgonda@google.com>  
Peter Hoyes <pahoyes@gmail.com>  
Peter Kleiweg <pkleiweg@xs4all.nl>  
Peter McKenzie <petermck@google.com>  
Peter

Moody <pmoody@uber.com>  
Peter Morjan <pmorjan@gmail.com>  
Peter Mundy <go.peter.90@gmail.com>  
Peter Nguyen <peter@mictis.com>  
Pter Surnyi <speter.go1@gmail.com>  
Pter Szab <pts@google.com>  
Pter Szilgyi <peterke@gmail.com>  
Peter Teichman <pteichman@fastly.com>  
Peter Tseng <ptseng@squareup.com>  
Peter Waldschmidt <peter@waldschmidt.com>  
Peter Waller <peter.waller@gmail.com>  
Peter Weinberger <pjw@golang.org>  
Peter Williams <pwil3058@gmail.com>  
Peter Wu <pwu@cloudflare.com>  
Peter Zhang <i@ddatsh.com>  
Petr Jedin <petr.jediny@gmail.com>  
Petrica Voicu <pvoicu@paypal.com>  
Phil Pearl <philip.j.r.pearl@gmail.com>  
Phil Pennock <pdp@golang.org>  
Philip Brgesen <philip.borgesen@gmail.com>  
Philip Brown <phil@bolthole.com>  
Philip Hofer <phofer@umich.edu>  
Philip K. Warren <pkwarren@gmail.com>  
Philip Nelson <me@pnelson.ca>  
Philipp Stephani <phst@google.com>  
Pierre Carru <pierre.carru@eshard.com>  
Pierre Durand <pierredurand@gmail.com>  
Pierre Prinetti <pierreprinetti@gmail.com>  
Pierre Roullon <pierre.roullon@gmail.com>  
Piers  
<google@hellopiers.pro>  
Pieter Droogendijk <pieter@binky.org.uk>  
Pietro Gagliardi <pietro10@mac.com>  
Piyush Mishra <piyush@codeitout.com>  
Plekhanov Maxim <kishtatix@gmail.com>  
Polina Osadcha <polliosa@google.com>  
Pontus Leitzler <leitzler@gmail.com>  
Povilas Versockas <p.versockas@gmail.com>  
Prasanga Siripala <pj@pjebs.com.au>  
Prasanna Swaminathan <prasanna@mediamath.com>  
Prashant Agrawal <prashant.a.vjti@gmail.com>  
Prashant Varanasi <prashant@prashantv.com>  
Praveen Kumar <praveen+git@kumar.in>  
Pravendra Singh <hackpravj@gmail.com>  
Preetam Jinka <pj@preet.am>  
Pure White <wu.purewhite@gmail.com>  
Qais Patankar <qaisjp@gmail.com>  
Qiuxuan Zhu <ilsh1022@gmail.com>

Quan Tran <qeed.quan@gmail.com>  
Quan Yong Zhai <qyzhai@gmail.com>  
Quentin Perez <qperez@ocs.online.net>  
Quentin Renard <contact@asticode.com>  
Quentin Smith <quentin@golang.org>  
Quey-Liang Kao <s101062801@m101.nthu.edu.tw>  
Quinn Slack <sqqs@sourcegraph.com>  
Quinten Yearsley <qyearsley@chromium.org>  
Quoc-Viet Nguyen  
<afelion@gmail.com>  
Radek Sohlich <sohlich@gmail.com>  
Radu Berinde <radu@cockroachlabs.com>  
Rafal Jeczalik <rjeczalik@gmail.com>  
Raghavendra Nagaraj <jamdagni86@gmail.com>  
Rahul Chaudhry <rahulchaudhry@chromium.org>  
Raif S. Naffah <go@naffah-raif.name>  
Rajat Goel <rajat.goel2010@gmail.com>  
Rajath Agasthya <rajathagasthya@gmail.com>  
Rajender Reddy Kompally <rajenderreddykompally@gmail.com>  
Ralph Corderoy <ralph@inputplus.co.uk>  
Ramazan AYYILDIZ <rayyildiz@gmail.com>  
Ramesh Dharan <dharan@google.com>  
Raph Levien <raph@google.com>  
Raphael Geronimi <raphael.geronimi@gmail.com>  
Raul Silvera <rsilvera@google.com>  
Ravil Bikbulatov <weeellz12@gmail.com>  
RaviTeja Pothana <ravi.tezu@gmail.com>  
Ray Tung <rtung@thoughtworks.com>  
Raymond Kazlauskas <raima220@gmail.com>  
Rebecca Stambler <rstambler@golang.org>  
Reilly Watson <reillywatson@gmail.com>  
Reinaldo de Souza Jr <juniorz@gmail.com>  
Remi Gillig <remigillig@gmail.com>  
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>  
Ren  
Ogaki <re.yuz77777@gmail.com>  
Rens Rikkerink <Ikkerens@users.noreply.github.com>  
Rhys Hiltner <rhys@justin.tv>  
Ricardo Padilha <ricardospadilha@gmail.com>  
Ricardo Seriani <ricardo.seriani@gmail.com>  
Richard Barnes <rlb@ipv.sx>  
Richard Crowley <r@rcrowley.org>  
Richard Dingwall <rdingwall@gmail.com>  
Richard Eric Gavaletz <gavaletz@gmail.com>  
Richard Gibson <richard.gibson@gmail.com>  
Richard Miller <miller.research@gmail.com>  
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>  
Richard Ulmer <codesoap@mailbox.org>



Richard Wilkes <wilkes@me.com>  
Rick Arnold <rickarnoldjr@gmail.com>  
Rick Hudson <rlh@golang.org>  
Rick Sayre <whorfin@gmail.com>  
Rijnard van Tonder <rvantonder@gmail.com>  
Riku Voipio <riku.voipio@linaro.org>  
Risto Jaakko Saarelm <rsaarelm@gmail.com>  
Rob Earhart <earhart@google.com>  
Rob Findley <rfindley@google.com>  
Rob Norman <rob.norman@infinitycloud.com>  
Rob Phoenix <rob@robphoenix.com>  
Rob Pike <r@golang.org>  
Robert Ayrapetyan <robert.ayrapetyan@gmail.com>  
Robert  
Daniel Kortschak <dan.kortschak@adelaide.edu.au> <dan@kortschak.io>  
Robert Dinu <r@varp.se>  
Robert Figueiredo <robfig@gmail.com>  
Robert Griesemer <gri@golang.org>  
Robert Hencke <robert.hencke@gmail.com>  
Robert Iannucci <iannucci@google.com>  
Robert Kuska <rkuska@gmail.com>  
Robert Obryk <robryk@gmail.com>  
Robert Seseke <rseseke@google.com>  
Robert Snedegar <roberts@google.com>  
Robert Stepanek <robert.stepanek@gmail.com>  
Robert van Gent <rvangent@google.com>  
Robert-Andr Mauchin <zebob.m@gmail.com>  
Roberto Clapis <robclap8@gmail.com>  
Roberto Selbach <roberto@selbach.ca>  
Robin Eklind <r.eklind.87@gmail.com>  
Robin Zhong <robin@robinzhong.co>  
Rodolfo Carvalho <rhcarvalho@gmail.com>  
Rodolfo Rodriguez <rodolfobgibson@gmail.com>  
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>  
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>  
Roger Pau Monn <royger@gmail.com>  
Roger Peppe <rogpeppe@gmail.com>  
Rohan Challa <rohan@golang.org>  
Rohan Verma <rohanverma2004@gmail.com>  
Rohith Ravi <entombedvirus@gmail.com>  
Roland  
Illig <roland.illig@gmx.de>  
Roland Shoemaker <rolandshoemaker@gmail.com>  
Romain Bague <romain.bague@elwinar.com>  
Roman Budnikov <romanyx90@yandex.ru>  
Roman Kollr <roman.kollar.0@gmail.com>  
Roman Shchekin <mrqtros@gmail.com>  
Ron Hashimoto <mail@h2so5.net>

Ron Minnich <rminnich@gmail.com>  
Ross Chater <rdchater@gmail.com>  
Ross Kinsey <rossikinsey@gmail.com>  
Ross Light <light@google.com> <rlight2@gmail.com>  
Ross Smith II <ross@smithii.com>  
Rowan Marshall <rowanajmarshall@gmail.com>  
Rowan Worth <sqweek@gmail.com>  
Rudi Kramer <rudi.kramer@gmail.com>  
Rui Ueyama <ruiu@google.com>  
Ruixin Bao <ruixin.bao@ibm.com>  
Ruslan Nigmatullin <elessar@dropbox.com>  
Russ Cox <rsc@golang.org>  
Russell Haering <russellhaering@gmail.com>  
Ryan Bagwell <ryanbagwell@outlook.com>  
Ryan Barrett <ryanb@google.com>  
Ryan Boehning <ryan.boehning@apcera.com>  
Ryan Brown <ribrdb@google.com>  
Ryan Canty <jrcanty@gmail.com>  
Ryan Dahl <ry@tinyclouds.org>  
Ryan Hitchman <hitchmanr@gmail.com>  
Ryan Lower <rpjlower@gmail.com>  
Ryan  
Roden-Corrent <ryan@rcorre.net>  
Ryan Seys <ryan@ryanseys.com>  
Ryan Slade <ryanslade@gmail.com>  
Ryan Zhang <ryan.zhang@docker.com>  
Ryoichi KATO <ryo1kato@gmail.com>  
Ryuji Iwata <qt.luigi@gmail.com>  
Ryuma Yoshida <ryuma.y1117@gmail.com>  
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>  
S.alar Onur <caglar@10ur.org>  
Sabin Mihai Rapan <sabin.rapan@gmail.com>  
Sad Pencil <qh06@qq.com>  
Sai Cheemalapati <saicheems@google.com>  
Sakeven Jiang <jc5930@sina.cn>  
Salmn Aljammz <s@0x65.net>  
Sam Arnold <sarnold64@bloomberg.net>  
Sam Boyer <tech@samboyer.org>  
Sam Chen <chenxsan@gmail.com>  
Sam Cross <samgcdev@gmail.com>  
Sam Ding <samding@ca.ibm.com>  
Sam Hug <samuel.b.hug@gmail.com>  
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>  
Sam Whited <sam@samwhited.com>  
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>  
Sami Commerot <samic@google.com>  
Sami Pnknen <sami.ponkanen@gmail.com>  
Samuel Kelemen <SCKelemen@users.noreply.github.com>

Samuel Tan <samueltan@google.com>  
Samuele Pedroni  
<pedronis@lucediaruna.net>  
Sander van Harmelen <sander@vanharmelen.nl>  
Sanjay Menakuru <balasanjay@gmail.com>  
Santhosh Kumar Tekuri <santhosh.tekuri@gmail.com>  
Sarah Adams <shadams@google.com>  
Sardorbek Pulatov <sardorbek.pulatov@outlook.com>  
Sascha Brawer <sascha@brawer.ch>  
Sasha Lionheart <lionhearts@google.com>  
Sasha Sobol <sasha@scaledinference.com>  
Scott Barron <scott.barron@github.com>  
Scott Bell <scott@sctsm.com>  
Scott Crunkleton <crunk1@gmail.com>  
Scott Ferguson <scottwferg@gmail.com>  
Scott Lawrence <bytbox@gmail.com>  
Scott Mansfield <smansfield@netflix.com>  
Scott Ragan <ragansa@fb.com>  
Scott Schwartz <scotts@golang.org>  
Scott Van Woudenberg <scottvw@google.com>  
Sean Burford <sburford@google.com>  
Sean Chen <oohcode@gmail.com>  
Sean Chittenden <seanc@joyent.com>  
Sean Christopherson <sean.j.christopherson@intel.com>  
Sean Dolphin <Sean.Dolphin@kpcompass.com>  
Sean Harger <sharger@google.com>  
Sean Liao <seankhliao@gmail.com>  
Sean Rees <sean@erifax.org>  
Sebastiaan van Stijn <github@gone.nl>  
Sebastian  
Chlopecki <sebsebmc@gmail.com>  
Sebastian Kinne <skinne@google.com>  
Sebastian Schmidt <yath@google.com>  
Sebastien Binet <seb.binet@gmail.com>  
Sbastien Paolacci <sebastien.paolacci@gmail.com>  
Sebastien Williams-Wynn <sebastien@cytora.com>  
Segev Finer <segev208@gmail.com>  
Seiji Takahashi <timaki.st@gmail.com>  
Sergei Lemeshkin <sergeilem@gmail.com>  
Sergei Skorobogatov <skorobo@rambler.ru>  
Sergei Zagurskii <gvozdoder@gmail.com>  
Sergey 'Snake' Gromov <snake.scaly@gmail.com>  
Sergey Arseev <sergey.arseev@intel.com>  
Sergey Dobrodey <sergey.dobrodey@synesis.ru>  
Sergey Frolov <sfrolov@google.com>  
Sergey Glushchenko <gsserge@gmail.com>  
Sergey Ivanov <ser1325@gmail.com>  
Sergey Lukjanov <me@slukjanov.name>

Sergey Mishin <sergeymishine@gmail.com>  
Sergey Mudrik <sergey.mudrik@gmail.com>  
Sergey Semin <gray12511@gmail.com>  
Sergey Yanykin <syanykin@ozon.ru>  
Sergio Luis O. B. Correia <sergio@correia.cc>  
Sergiusz Bazanski <bazanski@gmail.com>  
Serhat Giydiren <serhatgydiren@gmail.com>  
Serhii  
Aheienko <serhii.aheienko@gmail.com>  
Seth Hoenig <seth.a.hoenig@gmail.com>  
Seth Vargo <sethvargo@gmail.com>  
Shahar Kohanim <skohanim@gmail.com>  
Shamil Garatuev <garatuev@gmail.com>  
Shane Hansen <shanemhansen@gmail.com>  
Shang Jian Ding <sding3@ncsu.edu>  
Shaozhen Ding <dsz0111@gmail.com>  
Shaquille Wyan Que <shaqywyuan@gmail.com>  
Shaun Dunning <shaun.dunning@uservoice.com>  
Shawn Elliott <sellott@microsoft.com>  
Shawn Ledbetter <sledbetter@google.com>  
Shawn Smith <shawn.p.smith@gmail.com>  
Shawn Walker-Salas <shawn.walker@oracle.com>  
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>  
Shengjing Zhu <zs950618@gmail.com>  
Shengyu Zhang <shengyu.zhang@chaitin.com>  
Shi Han Ng <shihanng@gmail.com>  
Shijie Hao <haormj@gmail.com>  
Shinji Tanaka <shinji.tanaka@gmail.com>  
Shintaro Kaneko <kaneshin0120@gmail.com>  
Shivakumar GN <shivakumar.gn@gmail.com>  
Shivani Singhal <shivani.singhal2804@gmail.com>  
Shivansh Rai <shivansh@freebsd.org>  
Shivashis Padhi <shivashispadhi@gmail.com>  
Shubham Sharma <shubham.sha12@gmail.com>  
Shun  
Fan <sfan@google.com>  
Silvan Jegen <s.jegen@gmail.com>  
Simarpreet Singh <simar@linux.com>  
Simon Drake <simondrake1990@gmail.com>  
Simon Ferquel <simon.ferquel@docker.com>  
Simon Jefford <simon.jefford@gmail.com>  
Simon Rawet <simon@rawet.se>  
Simon Rozman <simon@rozman.si>  
Simon Thulbourn <simon+github@thulbourn.com>  
Simon Whitehead <chemnova@gmail.com>  
Sina Siadat <siadat@gmail.com>  
Sjoerd Siebinga <sjoerd.siebinga@gmail.com>  
Sokolov Yura <funny.falcon@gmail.com>

Song Gao <song@gao.io>  
Soojin Nam <jsunam@gmail.com>  
Sren L. Hansen <soren@linux2go.dk>  
Spencer Kocot <spencerkocot@gmail.com>  
Spencer Nelson <s@spenczar.com>  
Spencer Tung <spencertung@google.com>  
Spring Mc <heresy.mc@gmail.com>  
Srdjan Petrovic <spetrovic@google.com>  
Sridhar Venkatakrishnan <sridhar@laddoo.net>  
Srinidhi Kaushik <shrinidhi.kaushik@gmail.com>  
StalkR <stalkr@stalkr.net>  
Stan Schwertly <stan@schwertly.com>  
Stanislav Afanasev <php.progger@gmail.com>  
Steeve Morin <steeve.morin@gmail.com>  
Stefan Baebler  
<sbaebler@outbrain.com>  
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>  
Stepan Shabalin <neverliberty@gmail.com>  
Stephan Renatus <srenatus@chef.io>  
Stephan Zuercher <zuercher@gmail.com>  
Stphane Travostino <stephane.travostino@gmail.com>  
Stephen Lewis <stephen@sock.org.uk>  
Stephen Lu <steuhs@users.noreply.github.com>  
Stephen Ma <stephenm@golang.org>  
Stephen McQuay <stephen@mcquay.me>  
Stephen Searles <stephens2424@gmail.com>  
Stephen Weinberg <stephen@q5comm.com>  
Steve Francia <spf@golang.org>  
Steve Gilbert <stevegilbert23@gmail.com>  
Steve LoFurno <slofurno@gmail.com>  
Steve McCoy <mccoyst@gmail.com>  
Steve Mynott <steve.mynott@gmail.com>  
Steve Newman <snewman@google.com>  
Steve Phillips <elimistev@gmail.com>  
Steve Streeting <steve@stevestreeting.com>  
Steven Buss <sbuss@google.com>  
Steven Elliot Harris <seharris@gmail.com>  
Steven Erenst <stevenerenst@gmail.com>  
Steven Hartland <steven.hartland@multiplay.co.uk>  
Steven Littiebrant <imgroxx@gmail.com>  
Steven Wilkin  
<stevenwilkin@gmail.com>  
Stuart Jansen <sjansen@buscaluz.org>  
Sue Spence <virtuallysue@gmail.com>  
Sugu Sougoumarane <ssougou@gmail.com>  
Suharsh Sivakumar <suharshs@google.com>  
Sukrit Handa <sukrit.handa@utoronto.ca>  
Sunny <me@darkowlzz.space>

Suriyaa Sundararuban <suriyaasundararuban@gmail.com>  
Suyash <dextrous93@gmail.com>  
Suzy Mueller <suzmue@golang.org>  
Sven Almgren <sven@tras.se>  
Sven Blumenstein <svbl@google.com>  
Sven Taute <sven.taute@gmail.com>  
Sylvain Zimmer <sylvain@sylvainzimmer.com>  
Syohei YOSHIDA <syohex@gmail.com>  
Szabolcs Nagy <nsz@port70.net>  
Taavi Kivisik <taavi.kivisik@gmail.com>  
Tad Fisher <tadfisher@gmail.com>  
Tad Glines <tad.glines@gmail.com>  
Tadas Valiukas <tadovas@gmail.com>  
Tadeo Kondrak <me@tadeo.ca>  
Taesu Pyo <pyotaesu@gmail.com>  
Tai Le <letientai299@gmail.com>  
Taj Khattrra <taj.khattrra@gmail.com>  
Takashi Matsuo <tmatsuo@google.com>  
Takayoshi Nishida <takayoshi.nishida@gmail.com>  
Takeshi YAMANASHI <9.nashi@gmail.com>  
Takuto Ikuta <tikuta@google.com>  
Takuya Ueda  
<uedatakuya@gmail.com>  
Tal Shprecher <tshprecher@gmail.com>  
Tams Gulcsi <tgulacsi78@gmail.com>  
Tamir Duberstein <tamird@gmail.com>  
Tao Qingyun <qingyunha@gmail.com>  
Tao Shen <shentaoskyking@gmail.com>  
Tao Wang <twang2218@gmail.com>  
Tarmigan Casebolt <tarmigan@gmail.com>  
Taro Aoki <aizu.s1230022@gmail.com>  
Taru Karttunen <taruti@taruti.net>  
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>  
Tatsuya Kaneko <m.ddotx.f@gmail.com>  
Taufiq Rahman <taufiqrx8@gmail.com>  
Teague Cole <tnc1443@gmail.com>  
Ted Kornish <golang@tedkornish.com>  
Tejasvi Nareddy <tejunareddy@gmail.com>  
Terin Stock <terinjokes@gmail.com>  
Terrel Shumway <gopher@shumway.us>  
Tetsuo Kiso <tetsuokiso9@gmail.com>  
Than McIntosh <thanm@google.com>  
Thanabodee Charoenpiriyakij <wingyminus@gmail.com>  
Thanatat Tamtan <acoshift@gmail.com>  
The Hatsune Daishi <nao20010128@gmail.com>  
Thiago Avelino <t@avelino.xxx>  
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>  
Thomas Alan Copeland <talan.copeland@gmail.com>

Thomas Bonfort  
<thomas.bonfort@gmail.com>  
Thomas Bouldin <inlined@google.com>  
Thomas Bruyelle <thomas.bruyelle@gmail.com>  
Thomas Bushnell, BSG <tbushnell@google.com>  
Thomas de Zeeuw <thomasdezeeuw@gmail.com>  
Thomas Desrosiers <thomasdesr@gmail.com>  
Thomas Habets <habets@google.com>  
Thomas Kappler <tkappler@gmail.com>  
Thomas Meson <zllak@hycik.org>  
Thomas Symborski <thomas.symborski@gmail.com>  
Thomas Wanielista <tomwans@gmail.com>  
Thorben Krueger <thorben.krueger@gmail.com>  
Thordur Bjornsson <thorduri@secnorth.net>  
Tiago Queiroz <contato@tiago.eti.br>  
Tianji Wu <the729@gmail.com>  
Tianon Gravi <admwiggin@gmail.com>  
Tilman Dilo <tilman.dilo@gmail.com>  
Tim Cooijmans <timcooijmans@gmail.com>  
Tim Cooper <tim.cooper@layeh.com>  
Tim Ebringer <tim.ebringer@gmail.com>  
Tim Heckman <t@heckman.io>  
Tim Henderson <tim.tadh@gmail.com>  
Tim Hockin <thockin@google.com>  
Tim Mhlmann <muhlemmer@gmail.com>  
Tim Swast <swast@google.com>  
Tim Wright <tenortim@gmail.com>  
Tim Xu <xiaoxubei@gmail.com>  
Timmy Douglas <timmyd983@gmail.com>  
Timo  
Savola <timo.savola@gmail.com>  
Timo Truys <alkaloid.btx@gmail.com>  
Timothy Studd <tim@timstudd.com>  
Tipp Moseley <tipp@google.com>  
Tobias Assarsson <tobias.assarsson@gmail.com>  
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>  
Tobias Klauser <tklauser@distanz.ch>  
Toby Burrell <kurin@google.com>  
Todd Kulesza <tkulesza@google.com>  
Todd Neal <todd@tneal.org>  
Todd Wang <toddwang@gmail.com>  
Tom Anthony <git@tomanthony.co.uk>  
Tom Bergan <tombergan@google.com>  
Tom Heng <zhm20070928@gmail.com>  
Tom Lanyon <tomlanyon@google.com>  
Tom Levy <tomlevy93@gmail.com>  
Tom Limoncelli <tal@whatexit.org>  
Tom Linfoord <tomlinfoord@gmail.com>

Tom Parkin <tom.parkin@gmail.com>  
Tom Payne <twpayne@gmail.com>  
Tom Szymanski <tgs@google.com>  
Tom Thorogood <me+google@tomthorogood.co.uk>  
Tom Wilkie <tom@weave.works>  
Tomas Dabasinskas <tomas@dabasinskas.net>  
Tommy Schaefer <tommy.schaefer@teecom.com>  
Tomohiro Kusumoto <zabio1192@gmail.com>  
Tomoya Ishizaki <zaq1tomo@gmail.com>  
Tonis  
Tiigi <tonistiigi@gmail.com>  
Tony Reix <tony.reix@bull.net>  
Tony Walker <walkert.uk@gmail.com>  
Tooru Takahashi <tooru.takahashi134@gmail.com>  
Tor Andersson <tor.andersson@gmail.com>  
Torben Schinke <torben.schinke@neotos.de>  
Tormod Erevik Lea <tormodlea@gmail.com>  
Toshihiro Shiino <shiino.toshihiro@gmail.com>  
Toshiki Shima <hayabusa1419@gmail.com>  
Totoro W <tw19881113@gmail.com>  
Travis Bischel <travis.bischel@gmail.com>  
Travis Cline <travis.cline@gmail.com>  
Trevor Strohman <trevor.strohman@gmail.com>  
Trey Lawrence <lawrence.trey@gmail.com>  
Trey Roessig <trey.roessig@gmail.com>  
Trey Tacon <ttacon@gmail.com>  
Tristan Amini <tamini01@ca.ibm.com>  
Tristan Colgate <tcolgate@gmail.com>  
Tristan Oohry <ooohry@gmail.com>  
Tristan Rice <rice@fn.lc>  
Troels Thomsen <troels@thomsen.io>  
Trung Nguyen <trung.n.k@gmail.com>  
Tsuji Daishiro <dram.dt.shonan@gmail.com>  
Tudor Golubenco <tudor.g@gmail.com>  
Tugdual Saunier <tugdual.saunier@gmail.com>  
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>  
Tyler  
Bui-Palsulich <tpalsulich@google.com>  
Tyler Bunnell <tylerbunnell@gmail.com>  
Tyler Treat <ttreat31@gmail.com>  
Tyson Andre <tysonandre775@gmail.com>  
Tzach Shabtay <tzachshabtay@gmail.com>  
Tzu-Jung Lee <roylee17@currant.com>  
Udalov Max <re.udalov@gmail.com>  
Ugorji Nwoke <ugorji@gmail.com>  
Ulf Holm Nielsen <doktor@dyregod.dk>  
Ulrich Kunitz <uli.kunitz@gmail.com>  
Umang Parmar <umangjparmar@gmail.com>



Uriel Mangado <uriel@berlinblue.org>  
Urvil Patel <patelurvil38@gmail.com>  
Uttam C Pawar <uttam.c.pawar@intel.com>  
Vadim Grek <vadimprog@gmail.com>  
Vadim Vygonets <unixdj@gmail.com>  
Val Polouchkine <vpolouch@justin.tv>  
Valentin Vidic <vvidic@valentin-vidic.from.hr>  
Vee Zhang <veezhang@126.com> <vveezhang@gmail.com>  
Vega Garcia Luis Alfonso <vegacom@gmail.com>  
Venil Noronha <veniln@vmware.com>  
Veselkov Konstantin <kostozyb@gmail.com>  
Viacheslav Poturaev <vearutop@gmail.com>  
Victor Chudnovsky <vchudnov@google.com>  
Victor Vrantchan <vrancean+github@gmail.com>  
Vignesh Ramachandra <vickyramachandra@gmail.com>  
Vikas  
Kedia <vikask@google.com>  
Ville Skytt <ville.skytta@iki.fi>  
Vincent Ambo <tazjin@googlemail.com>  
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>  
Vincent Vanackere <vincent.vanackere@gmail.com>  
Vinu Rajashekhar <vinutheraj@gmail.com>  
Vish Subramanian <vish@google.com>  
Vishvananda Ishaya <vishvananda@gmail.com>  
Visweswara R <r.visweswara@gmail.com>  
Vitaly Zdanevich <zdanevich.vitaly@ya.ru>  
Vitor De Mario <vitordemario@gmail.com>  
Vivek Sekhar <vsekhar@google.com>  
Vivian Liang <vliang88@gmail.com>  
Vlad Krasnov <vlad@cloudflare.com>  
Vladimir Evgrafov <evgrafov.vladimir@gmail.com>  
Vladimir Kovpak <cn007b@gmail.com>  
Vladimir Kuzmin <vkuzmin@uber.com>  
Vladimir Mihailenco <vladimir.webdev@gmail.com>  
Vladimir Nikishenko <vova616@gmail.com>  
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>  
Vladimir Varankin <nek.narqo@gmail.com>  
Vojtech Bocek <vbocek@gmail.com>  
Volker Dobler <dr.volker.dobler@gmail.com>  
Volodymyr Paprotski <vpaprots@ca.ibm.com>  
W. Trevor King <wking@tremily.us>  
Wade  
Simmons <wade@wades.im>  
Wagner Riffel <wgriffel@gmail.com>  
Walt Della <walt@javins.net>  
Walter Poupore <wpoupore@google.com>  
Wander Lairson Costa <wcosta@mozilla.com>  
Wang Xuerui <git@xen0n.name>

Warren Fernandes <warren.f.fernandes@gmail.com>  
Wayne Ashley Berry <wayneashleyberry@gmail.com>  
Wedson Almeida Filho <wedsonaf@google.com>  
Weerasak Chongnguluam <singpor@gmail.com>  
Wi Cngru <crvv.mail@gmail.com>  
Wei Fu <fhfuwei@163.com>  
Wei Guangjing <vcc.163@gmail.com>  
Wei Xiao <wei.xiao@arm.com>  
Wei Xikai <xykwei@gmail.com>  
Weichao Tang <tevic.tt@gmail.com>  
Wembley G. Leach, Jr <wembley.gl@gmail.com>  
Wenlei (Frank) He <wlhe@google.com>  
Wenzel Lowe <lowewenzel@gmail.com>  
Wil Selwood <wselwood@gmail.com>  
Wilfried Teiken <wteiken@google.com>  
Will Beason <willbeason@gmail.com>  
Will Chan <willchan@google.com>  
Will Faught <will.faught@gmail.com>  
Will Morrow <wmorrow.qdt@qualcommdatacenter.com>  
Will Norris <willnorris@google.com>  
Will Storey <will@summercat.com>  
Willem van der Schyff  
<willemvds@gmail.com>  
William Chan <willchan@chromium.org>  
William Chang <mr.williamchang@gmail.com>  
William Josephson <wjosephson@gmail.com>  
William Orr <will@worrbase.com> <ay1244@gmail.com>  
William Poussier <william.poussier@gmail.com>  
Wisdom Omuya <deafgoat@gmail.com>  
Wu Yunzhou <yunzhouwu@gmail.com>  
Xi Ruoyao <xry23333@gmail.com>  
Xia Bin <snyh@snyh.org>  
Xiangdong Ji <xiangdong.ji@arm.com>  
Xing Xing <mikespook@gmail.com>  
Xingqiang Bai <bxq2011hust@qq.com>  
Xu Fei <badgangkiller@gmail.com>  
Xudong Zhang <felixmelon@gmail.com>  
Xudong Zheng <7pkvm5aw@slicealias.com>  
Xuyang Kang <xuyangkang@gmail.com>  
Yamagishi Kazutoshi <ykzts@desire.sh>  
Yan Zou <yzou@google.com>  
Yang Hau <vulxj0j8j8@gmail.com>  
Yang Tian <linuxty@gmail.com>  
Yann Hodique <yhodique@google.com>  
Yann Kerherv <yann.kerherv@gmail.com>  
Yann Salan <yannsalaun1@gmail.com>  
Yannic Bonenberger <contact@yannic-bonenberger.com>  
Yao Zhang <lunaria21@gmail.com>

Yaron de Leeuw <jarondl@google.com>  
Yaroslav Vorobiov <yar.vorobiov@gmail.com>  
Yasha  
Bubnov <girokompass@gmail.com>  
Yasser Abdolmaleki <yasser@yasser.ca>  
Yasuharu Goto <matope.ono@gmail.com>  
Yasuhiro Matsumoto <mattn.jp@gmail.com>  
Yasuyuki Oka <yasuyk@gmail.com>  
Yazen Shunnar <yazen.shunnar@gmail.com>  
Yestin Sun <ylh@pdx.edu>  
Yesudeep Mangalapilly <yesudeep@google.com>  
Yissakhar Z. Beck <yissakhar.beck@gmail.com>  
Yo-An Lin <yoanlin93@gmail.com>  
Yohei Takeda <yo.tak0812@gmail.com>  
Yongjian Xu <i3dmaster@gmail.com>  
Yorman Arias <cixtords@gmail.com>  
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>  
Yoshiyuki Mineo <yoshiyuki.mineo@gmail.com>  
Yosuke Akatsuka <yosuke.akatsuka@gmail.com>  
Yu Heng Zhang <annita.zhang@cn.ibm.com>  
Yu Xuan Zhang <zyxsh@cn.ibm.com>  
Yuichi Kishimoto <yk2220s@gmail.com>  
Yuichi Nishiwaki <yuichi.nishiwaki@gmail.com>  
Yuji Yaginuma <yuuji.yaginuma@gmail.com>  
Yuki OKUSHI <huyuumi.dev@gmail.com>  
Yuki Yugui Sonoda <yugui@google.com>  
Yukihiro Nishinaka <6elpinal@gmail.com>  
Yury Smolsky <yury@smolsky.by>  
Yusuke Kagiwada <block.rxckin.beats@gmail.com>  
Yuusei  
Kuwana <kuwana@kumama.org>  
Yuval Pavel Zholkover <paulzhol@gmail.com>  
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>  
Zac Bergquist <zbergquist99@gmail.com>  
Zach Bintliff <zbintliff@gmail.com>  
Zach Gershman <zachgersh@gmail.com>  
Zach Jones <zachj1@gmail.com>  
Zachary Amsden <zach@thundertoken.com>  
Zachary Gershman <zgershman@pivotal.io>  
Zak <zrjknill@gmail.com>  
Zakatell Kanda <hi@zkanda.io>  
Zellyn Hunter <zellyn@squareup.com> <zellyn@gmail.com>  
Zev Goldstein <zev.goldstein@gmail.com>  
Zhang Boyang <zhangboyang.id@gmail.com>  
Zheng Dayu <davidzheng23@gmail.com>  
Zheng Xu <zheng.xu@arm.com>  
Zhengyu He <hzy@google.com>  
Zhongpeng Lin <zplin@uber.com>

Zhongtao Chen <chenzhongtao@126.com>  
Zhongwei Yao <zhongwei.yao@arm.com>  
Zhou Peng <p@ctriple.cn>  
Ziad Hatahet <hatahet@gmail.com>  
Ziheng Liu <lzhfromustc@gmail.com>  
Zorion Arrizabalaga <zorionk@gmail.com>  
<a.maksadbek@gmail.com>  
<max.faceless.frei@gmail.com>  
<hagen1778@gmail.com>  
<tbunyk@gmail.com>  
<faxriddinjon@gmail.com>  
<zs349596@gmail.com>  
<bronze1man@gmail.com>

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```
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Name <email address>
Raul Silvera <rsilvera@google.com>
Tipp Moseley <tipp@google.com>
Hyoun Kyu Cho <netforce@google.com>
Martin Spier <spiermar@gmail.com>
```



Taco de Wolff <tacodewolff@gmail.com>  
Andrew Hunter <andrewhunter@gmail.com>  
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\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/FileLog.java  
\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/ConsoleLogCreator.java  
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\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/CommandLineArguments.java

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\* /opt/cola/permits/1274024552\_1645166710.08/0/flyway-commandline-7-3-1-sources-jar/META-INF/maven/org.flywaydb/flyway-commandline/pom.xml

## 1.279 libxml2 2.9.4

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## 1.280 cryptsetup 2.3.6

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\* Author: Luke Hutchison

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jar/nonapi/io/github/classgraph/fileslice/reader/RandomAccessArrayReader.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fileslice/FileSlice.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fileslice/reader/RandomAccessByteBufferReader.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fileslice/reader/RandomAccessFileReader.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fileslice/reader/ClassfileReader.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fileslice/ArraySlice.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fileslice/reader/SequentialReader.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fileslice/reader/RandomAccessReader.java
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\* Author: Johno Crawford (johno@sulake.com)

\*

\* Hosted at: <https://github.com/classgraph/classgraph>

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\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/concurrency/SimpleThreadFactory.java

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\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/nonapi/io/github/classgraph/classloaderhandler/AntClassLoaderHandler.java  
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jar/nonapi/io/github/classgraph/classloaderhandler/SpringBootRestartClassLoaderHandler.java

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\* Author: R. Kempees

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\* With contributions from @cpierceworld (#414)

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jar/nonapi/io/github/classgraph/classloaderhandler/WebsphereLibertyClassLoaderHandler.java
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\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-

jar/nonapi/io/github/classgraph/classpath/ClasspathFinder.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/scanspec/WhiteBlackList.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/utils/LogNode.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/types/Parser.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/InfoList.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/FieldInfoList.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ClassRefTypeSignature.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/fastzipfilereader/PhysicalZipFile.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ClassTypeSignature.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/FieldInfo.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ClassGraphClassLoader.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/utils/Join.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/TypeArgument.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ObjectTypedValueWrapper.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/recycler/Recycler.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/json/FieldTypeInfo.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/ClasspathElementDir.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/json/Id.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/json/JSONObject.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/AnnotationParameterValue.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/io/github/classgraph/AnnotationInfo.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/utils/JarUtils.java  
\*  
/opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
jar/nonapi/io/github/classgraph/json/JSONReference.java  
\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-



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jar/nonapi/io/github/classgraph/json/JSONUtils.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/TypeResolutions.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ModulePathInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/TypeSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/recycler/RecycleOnClose.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/PackageInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/FallbackClassLoaderHandler.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fastzipfilereader/LogicalZipFile.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/ClassLoaderHandlerRegistry.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/ReferenceEqualityKey.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/GraphvizDotfileGenerator.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/Classfile.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/AnnotationClassRef.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/PlexusClassWorldsClassRealmClassLoaderHandler.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MethodParameterInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classpath/ClasspathOrder.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/ParameterizedTypeImpl.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/HierarchicalTypeSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/TypeParameter.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/ClassFields.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClassRefOrTypeVariableSignature.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classpath/CallStackReader.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-

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jar/io/github/classgraph/Resource.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MappableInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MethodInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/concurrency/InterruptedException.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONSerializer.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/types/TypeUtils.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClasspathElementZip.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fastzipfilereader/ZipFileSlice.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/FastPathResolver.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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jar/io/github/classgraph/AnnotationParameterValueList.java
*
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* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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jar/nonapi/io/github/classgraph/concurrency/SingletonMap.java
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jar/nonapi/io/github/classgraph/classpath/ModuleFinder.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
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* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONParser.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/FileUtils.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-

```

```

jar/io/github/classgraph/ClasspathElementModule.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/OSGiDefaultClassLoaderHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/types/ParseException.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/JPMSCClassLoaderHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ScanResult.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ReferenceTypeSignature.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ModuleReaderProxy.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ScanResultObject.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ModuleInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/TypeVariableSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fastzipfilereader/NestedJarHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/JSONArray.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MethodInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classpath/ClassLoaderOrder.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/WeblogicClassLoaderHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/PackageInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-jar/io/github/classgraph/Scanner.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/AnnotationInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/concurrency/WorkQueue.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/json/ClassFieldCache.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/BaseTypeSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/PotentiallyUnmodifiableList.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/recycler/Resetable.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-

```

```
jar/nonapi/io/github/classgraph/classpath/ClassLoaderFinder.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/ReflectionUtils.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/VersionFinder.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/EquinoxClassLoaderHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/MethodTypeSignature.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/scanspec/ScanSpec.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClasspathElement.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ArrayClassInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClassGraph.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/CollectionUtils.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/Utils/URLPathEncoder.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/ClassLoaderHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ClassInfoList.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/ParentLastDelegationOrderTestClassLoaderHandler.java
*
/opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/fastzipfilereader/FastZipEntry.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/io/github/classgraph/ModuleInfo.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/URLClassLoaderHandler.java
* /opt/cola/permits/1288552318_1647355543.96/0/classgraph-4-8-69-sources-
jar/nonapi/io/github/classgraph/classloaderhandler/TomcatWebappClassLoaderBaseHandler.java
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```

```
/*
* This file is part of ClassGraph.
*
* Author: Luke Hutchison
*
* Hosted at: https://github.com/classgraph/classgraph
*
* --
*
```

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 \*/

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\* /opt/cola/permits/1288552318\_1647355543.96/0/classgraph-4-8-69-sources-  
 jar/nonapi/io/github/classgraph/classloaderhandler/JBossClassLoaderHandler.java

## 1.282 libnetfilter-contrack 1.0.5

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- \*
- \* @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
- \* @author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
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Found in path(s):

```
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiResponse.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiParam.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ExtensionProperty.java
*
/opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/AuthorizationScope.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiOperation.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/SwaggerDefinition.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
jar/io/swagger/annotations/ApiModelProperty.java
* /opt/cola/permits/1316840807_1651048916.85/0/swagger-annotations-1-5-22-sources-2-
```



jar/io/swagger/annotations/ApiImplicitParam.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/ExampleProperty.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/ApiModel.java  
\*  
/opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/ExternalDocs.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/Example.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/Authorization.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/License.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/Api.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/Info.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/Contact.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/ApiImplicitParams.java  
\*  
/opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/Tag.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/Extension.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/ResponseHeader.java  
\* /opt/cola/permits/1316840807\_1651048916.85/0/swagger-annotations-1-5-22-sources-2-  
jar/io/swagger/annotations/ApiResponses.java

# 1.286 libatomic 10.3.0-1ubuntu1-20.04

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ftp://gcc.gnu.org/pub/gcc/releases/ (for full releases)  
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 git://git.savannah.gnu.org/gm2.git (for Modula-2)

The current gcc-10 source package is taken from the SVN gcc-10-branch.

Changes: See changelog.Debian.gz

Debian splits the GNU Compiler Collection into packages for each language, library, and documentation as follows:

Language	Compiler package	Library package	Documentation
Ada	gnat-10	libgnat-10	gnat-10-doc
BRIG	gccbrig-10	libhsail-rt0	
C	gcc-10		gcc-10-doc
C++	g++-10	libstdc++6	libstdc++6-10-doc
D	gdc-10		
Fortran 95	gfortran-10	libgfortran5	gfortran-10-doc
Go	gccgo-10	libgo0	
Objective C	gobjc-10	libobjc4	

Objective C++ gobjc++-10  
Modula-2 gm2-10 libgm2

For some language run-time libraries, Debian provides source files, development files, debugging symbols and libraries containing position-independent code in separate packages:

Language	Sources	Development	Debugging	Position-Independent
C++		libstdc++6-10-dbg	libstdc++6-10-pic	
D	libphobos-10-dev			

Additional packages include:

All languages:

libgcc1,	
libgcc2, libgcc4	GCC intrinsics (platform-dependent)
gcc-10-base	Base files common to all compilers
gcc-10-soft-float	Software floating point (ARM only)
gcc-10-source	The sources with patches

Ada:

libgnat-util10-dev, libgnat-util10 GNAT version library

C:

cpp-10, cpp-10-doc	GNU C Preprocessor
libssp0-dev, libssp0	GCC stack smashing protection library
libquadmath0	Math routines for the __float128 type
fixincludes	Fix non-ANSI header files

C, C++ and Fortran 95:

libgomp1-dev, libgomp1 GCC OpenMP (GOMP) support library  
libitm1-dev, libitm1 GNU Transactional Memory Library

Biarch support: On some 64-bit platforms which can also run 32-bit code, Debian provides additional packages containing 32-bit versions of some libraries. These packages have names beginning with 'lib32' instead of 'lib', for example lib32stdc++6. Similarly, on some 32-bit platforms which can

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- libatomic
- libdecnumber
- libgomp
- libitm
- libssp
- libstdc++-v3
- libobjc
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Developed by:

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Version 3.1, 31 March 2009

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- \* Cygnus Support, drepper@cygnus.com.

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D:

gdc-10                    GNU D Compiler  
libphobos-10-dev        D standard runtime library

The D source package is made up of the following components.

The D front-end for GCC:

- d/\*

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The DMD Compiler implementation of the D programming language:

- d/dmd/\*

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The Zlib data compression library:

- `d/phobos/etc/c/zlib/*`

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The Phobos standard runtime library:

- `d/phobos/*`

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DRuntime: Runtime Library for the D Programming Language

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```
<program> Copyright (C) <year> <name of author>
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```

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\*\*\*\*\*

Version 2, June 1991

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[This is the first released version of the library GPL. It is numbered 2 because it goes with version 2 of the ordinary GPL.]

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=====

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<!-- Generate ISC copyright comments from Docbook copyright metadata. -->

```

<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:xi="http://www.w3.org/2001/XInclude"
xmlns:db="http://docbook.org/ns/docbook">

<xsl:template name="isc.copyright.format">
 <xsl:param name="text"/>
 <xsl:value-of select="$isc.copyright.leader"/>
 <xsl:value-of select="normalize-space(substring-before($text, '
'))"/>
 <xsl:text>
</xsl:text>
 <xsl:variable name="rest" select="substring-after($text, '
')"/>
 <xsl:if test="translate($rest, '	 ', '')">
 <xsl:call-template name="isc.copyright.format">
 <xsl:with-param name="text" select="$rest"/>
 </xsl:call-template>
 </xsl:if>
</xsl:template>

<xsl:variable name="isc.copyright.text">
 <xsl:text>
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 </xsl:text>
</xsl:variable>

<xsl:variable name="isc.copyright">
 <xsl:call-template name="isc.copyright.format">
 <xsl:with-param name="text">
 <xsl:for-each select="db:book/db:info/db:copyright | db:refentry/db:docinfo/db:copyright">
 <xsl:text>Copyright (C) </xsl:text>
 <xsl:call-template name="copyright.years">
 <xsl:with-param name="years" select="db:year"/>
 </xsl:call-template>
 <xsl:text> </xsl:text>
 <xsl:value-of select="db:holder"/>
 <xsl:value-of select="$isc.copyright.breakline"/>
 <xsl:text>
</xsl:text>
 </xsl:for-each>
 </xsl:with-param>
 </xsl:call-template>
</xsl:variable>

```

```
select="$isc.copyright.text"/>
 </xsl:with-param>
</xsl:call-template>
</xsl:variable>
</xsl:stylesheet>
```

<!--

- Local variables:

- mode: sgml

- End:

-->

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Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6.

Any executables containing that work also fall under Section 6,

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## 1.298 postgresql 12.12

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# 1.299 iptables 1.8.8

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```
/*
 * libipq.h
 *
 * IPQ library for userspace.
 *
 * Author: James Morris <jmorris@intercode.com.au>
 *
 * Copyright (c) 2000-2001 Netfilter Core Team
 *
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 *
 */
```

Found in path(s):

```
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/include/libipq.h
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```

Found in path(s):

```
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/arptables-nft-save-8-gz/arptables-nft-save.8
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
```

xz/usr/share/man/man8/iptables-save-8-gz/iptables-save.8

\*

/opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man1/iptables-xml-1-gz/iptables-xml.1

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/iptables-8-gz/iptables.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/arptables-nft-restore-8-gz/arptables-nft-restore.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/iptables-restore-8-gz/iptables-restore.8

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\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/eatables-nft-8-gz/eatables-nft.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-xz/usr/share/man/man8/arptables-nft-8-gz/arptables-nft.8

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# \$FreeBSD: head/etc/pf.os 258865 2013-12-03 04:32:02Z eadler \$

```
$OpenBSD: pf.os,v 1.27 2016/09/03 17:08:57 sthen Exp $
passive OS fingerprinting

#
SYN signatures. Those signatures work for SYN packets only (duh!).
#
(C) Copyright 2000-2003 by Michal Zalewski <lcamtuf@coredump.cx>
(C) Copyright 2003 by Mike Frantzen <frantzen@w4g.org>
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#
#
This fingerprint database is adapted from Michal Zalewski's p0f passive
operating system package. The last database sync was from a Nov 3 2003
p0f.fp.
#
#
Each line in this file specifies a single fingerprint. Please read the
information below carefully before attempting to append any signatures
reported as UNKNOWN to this file to avoid mistakes.
#
We use the following set metrics for fingerprinting:
#
- Window size (WSS) - a highly OS dependent setting used for TCP/IP
performance control (max. amount of data to be sent without ACK).
Some systems use a fixed value for initial packets. On other
systems, it is a multiple of MSS or MTU (MSS+40). In some rare
cases, the value is just arbitrary.
#
NEW SIGNATURE: if p0f reported a special value of 'Snn', the number
appears to be
a multiple of MSS (MSS*nn); a special value of 'Tnn'
means it is a multiple of MTU ((MSS+40)*nn). Unless you notice the
value of nn is not fixed (unlikely), just copy the Snn or Tnn token
literally. If you know this device has a simple stack and a fixed
MTU, you can however multiply S value by MSS, or T value by MSS+40,
and put it instead of Snn or Tnn.
```



```
#
If WSS otherwise looks like a fixed value (for example a multiple
of two), or if you can confirm the value is fixed, please quote
it literally. If there's no apparent pattern in WSS chosen, you
should consider wildcarding this value.
#
- Overall packet size - a function of all IP and TCP options and bugs.
#
NEW SIGNATURE: Copy this value literally.
#
- Initial TTL - We check the actual TTL of a received packet. It can't
be higher than the initial TTL, and also shouldn't be dramatically
lower (maximum distance is defined as 40 hops).
#
NEW SIGNATURE: *Never* copy TTL from a p0f-reported
signature literally.
You need to determine the initial TTL. The best way to do it is to
check the documentation for a remote system, or check its settings.
A fairly good method is to simply round the observed TTL up to
32, 64, 128, or 255, but it should be noted that some obscure devices
might not use round TTLs (in particular, some shoddy appliances use
"original" initial TTL settings). If not sure, you can see how many
hops you're away from the remote party with traceroute or mtr.
#
- Don't fragment flag (DF) - some modern OSES set this to implement PMTU
discovery. Others do not bother.
#
NEW SIGNATURE: Copy this value literally.
#
- Maximum segment size (MSS) - this setting is usually link-dependent. P0f
uses it to determine link type of the remote host.
#
NEW SIGNATURE: Always wildcard this value, except for rare cases when
you have an appliance with a fixed value, know the system supports only
a very limited number of
network interface types, or know the system
is using a value it pulled out of nowhere. Specific unique MSS
can be used to tell Google crawlbots from the rest of the population.
#
- Window scaling (WSCALE) - this feature is used to scale WSS.
It extends the size of a TCP/IP window to 32 bits. Some modern
systems implement this feature.
#
NEW SIGNATURE: Observe several signatures. Initial WSCALE is often set
to zero or other low value. There's usually no need to wildcard this
parameter.
#
- Timestamp - some systems that implement timestamps set them to
```

```

zero in the initial SYN. This case is detected and handled appropriately.
#
- Selective ACK permitted - a flag set by systems that implement
selective ACK functionality.
#
- The sequence of TCP all options (MSS, window scaling, selective ACK
permitted, timestamp, NOP). Other than the options previously
discussed, p0f also checks for timestamp option (a silly
extension to broadcast your
uptime ;-), NOP options (used for
header padding) and sackOK option (selective ACK feature).
#
NEW SIGNATURE: Copy the sequence literally.
#
To wildcard any value (except for initial TTL or TCP options), replace
it with '*'. You can also use a modulo operator to match any values
that divide by nnn - '%nnn'.
#
Fingerprint entry format:
#
www:ttt:D:ss:OOO...:OS:Version:Subtype:Details
#
wwww - window size (can be *, %nnn, Snn or Tnn). The special values
"S" and "T" which are a multiple of MSS or a multiple of MTU
respectively.
ttt - initial TTL
D - don't fragment bit (0 - not set, 1 - set)
ss - overall SYN packet size
OOO - option value and order specification (see below)
OS - OS genre (Linux, Solaris, Windows)
Version - OS Version (2.0.27 on x86, etc)
Subtype - OS subtype or patchlevel (SP3, lo0)
details - Generic OS details
#
If OS genre starts with '*', p0f will not show distance,
link type
and timestamp data. It is useful for userland TCP/IP stacks of
network scanners and so on, where many settings are randomized or
bogus.
#
If OS genre starts with @, it denotes an approximate hit for a group
of operating systems (signature reporting still enabled in this case).
Use this feature at the end of this file to catch cases for which
you don't have a precise match, but can tell it's Windows or FreeBSD
or whatnot by looking at, say, flag layout alone.
#
Option block description is a list of comma or space separated
options in the order they appear in the packet:

```

```
#
N - NOP option
Wnnn - window scaling option, value nnn (or * or % nnn)
Mnnn - maximum segment size option, value nnn (or * or % nnn)
S - selective ACK OK
T - timestamp
T0 - timestamp with a zero value
#
To denote no TCP options, use a single '!'.
#
Please report any additions to this file, or any inaccuracies or
problems spotted, to the maintainers: lcamtuf@coredump.cx,
#
frantzen@openbsd.org and bugs@openbsd.org with a tcpdump packet
capture of the relevant SYN packet(s)
#
A test and submission page is available at
http://lcamtuf.coredump.cx/p0f-help/
#
#
WARNING WARNING WARNING

#
Do not add a system X as OS Y just because NMAP says so. It is often
the case that X is a NAT firewall. While nmap is talking to the
device itself, p0f is fingerprinting the guy behind the firewall
instead.
#
When in doubt, use common sense, don't add something that looks like
a completely different system as Linux or FreeBSD or LinkSys router.
Check DNS name, establish a connection to the remote host and look
at SYN+ACK - does it look similar?
#
Some users tweak their TCP/IP settings - enable or disable RFC1323
functionality, enable or disable timestamps or selective ACK,
disable PMTU discovery, change MTU and so on. Always compare a new rule
to other fingerprints for this system, and verify the system
isn't
"customized" before adding it. It is OK to add signature variants
caused by a commonly used software (personal firewalls, security
packages, etc), but it makes no sense to try to add every single
possible /proc/sys/net/ipv4 tweak on Linux or so.
#
KEEP IN MIND: Some packet firewalls configured to normalize outgoing
traffic (OpenBSD pf with "scrub" enabled, for example) will, well,
normalize packets. Signatures will not correspond to the originating
system (and probably not quite to the firewall either).
#
```

# NOTE: Try to keep this file in some reasonable order, from most to  
# least likely systems. This will speed up operation. Also keep most  
# generic and broad rules near the end.  
#

#####  
# Standard OS signatures #  
#####

# ----- AIX -----

# AIX is first because its signatures are close to NetBSD, MacOS X and  
# Linux 2.0, but it uses a fairly rare MSSes, at least sometimes...  
# This is a shoddy  
hack, though.

45046:64:0:44:M\*: AIX:4.3::AIX 4.3

16384:64:0:44:M512: AIX:4.3:2-3:AIX 4.3.2 and earlier

16384:64:0:60:M512,N,W%2,N,N,T: AIX:4.3:3:AIX 4.3.3-5.2

16384:64:0:60:M512,N,W%2,N,N,T: AIX:5.1-5.2::AIX 4.3.3-5.2

32768:64:0:60:M512,N,W%2,N,N,T: AIX:4.3:3:AIX 4.3.3-5.2

32768:64:0:60:M512,N,W%2,N,N,T: AIX:5.1-5.2::AIX 4.3.3-5.2

65535:64:0:60:M512,N,W%2,N,N,T: AIX:4.3:3:AIX 4.3.3-5.2

65535:64:0:60:M512,N,W%2,N,N,T: AIX:5.1-5.2::AIX 4.3.3-5.2

65535:64:0:64:M\*,N,W1,N,N,T,N,N,S: AIX:5.3:ML1:AIX 5.3 ML1

# ----- Linux -----

# S1:64:0:44:M\*:A: Linux:1.2::Linux 1.2.x (XXX quirks support)

512:64:0:44:M\*: Linux:2.0:3x:Linux 2.0.3x

16384:64:0:44:M\*: Linux:2.0:3x:Linux 2.0.3x

# Endian snafu! Nelson says "ha-ha":

2:64:0:44:M\*: Linux:2.0:3x:Linux 2.0.3x (MkLinux) on Mac

64:64:0:44:M\*: Linux:2.0:3x:Linux 2.0.3x (MkLinux) on Mac

S4:64:1:60:M1360,S,T,N,W0: Linux:google::Linux (Google crawlbot)

S2:64:1:60:M\*,S,T,N,W0: Linux:2.4::Linux 2.4 (big boy)

S3:64:1:60:M\*,S,T,N,W0: Linux:2.4:.18-21:Linux

2.4.18 and newer

S4:64:1:60:M\*,S,T,N,W0: Linux:2.4::Linux 2.4/2.6 <= 2.6.7

S4:64:1:60:M\*,S,T,N,W0: Linux:2.6:.1-7:Linux 2.4/2.6 <= 2.6.7

S4:64:1:60:M\*,S,T,N,W5: Linux:2.6::Linux 2.6 (newer, 1)

S4:64:1:60:M\*,S,T,N,W6: Linux:2.6::Linux 2.6 (newer, 2)

S4:64:1:60:M\*,S,T,N,W7: Linux:2.6::Linux 2.6 (newer, 3)

T4:64:1:60:M\*,S,T,N,W7: Linux:2.6::Linux 2.6 (newer, 4)

S10:64:1:60:M\*,S,T,N,W4: Linux:3.0::Linux 3.0

S3:64:1:60:M\*,S,T,N,W1: Linux:2.5::Linux 2.5 (sometimes 2.4)

S4:64:1:60:M\*,S,T,N,W1: Linux:2.5-2.6::Linux 2.5/2.6

S3:64:1:60:M\*,S,T,N,W2: Linux:2.5::Linux 2.5 (sometimes 2.4)

S4:64:1:60:M\*,S,T,N,W2: Linux:2.5::Linux 2.5 (sometimes 2.4)

S20:64:1:60:M\*,S,T,N,W0: Linux:2.2:20-25:Linux 2.2.20 and newer

S22:64:1:60:M\*,S,T,N,W0: Linux:2.2::Linux 2.2

S11:64:1:60:M\*,S,T,N,W0: Linux:2.2::Linux 2.2

# Popular cluster config scripts disable timestamps and

# selective ACK:

S4:64:1:48:M1460,N,W0: Linux:2.4:cluster:Linux 2.4 in cluster

#

This needs to be investigated. On some systems, WSS

# is selected as a multiple of MTU instead of MSS. I got

# many submissions for this for many late versions of 2.4:

T4:64:1:60:M1412,S,T,N,W0: Linux:2.4::Linux 2.4 (late, uncommon)

# This happens only over loopback, but let's make folks happy:

32767:64:1:60:M16396,S,T,N,W0: Linux:2.4:lo0:Linux 2.4 (local)

S8:64:1:60:M3884,S,T,N,W0: Linux:2.2:lo0:Linux 2.2 (local)

# Opera visitors:

16384:64:1:60:M\*,S,T,N,W0: Linux:2.2:Opera:Linux 2.2 (Opera?)

32767:64:1:60:M\*,S,T,N,W0: Linux:2.4:Opera:Linux 2.4 (Opera?)

# Some fairly common mods:

S4:64:1:52:M\*,N,N,S,N,W0: Linux:2.4:ts:Linux 2.4 w/o timestamps

S22:64:1:52:M\*,N,N,S,N,W0: Linux:2.2:ts:Linux 2.2 w/o timestamps

# ----- FreeBSD -----

16384:64:1:44:M\*: FreeBSD:2.0-2.2::FreeBSD 2.0-4.2

16384:64:1:44:M\*: FreeBSD:3.0-3.5::FreeBSD 2.0-4.2

16384:64:1:44:M\*: FreeBSD:4.0-4.2::FreeBSD 2.0-4.2

16384:64:1:60:M\*,N,W0,N,N,T: FreeBSD:4.4::FreeBSD 4.4

1024:64:1:60:M\*,N,W0,N,N,T: FreeBSD:4.4::FreeBSD

4.4

57344:64:1:44:M\*: FreeBSD:4.6-4.8:noRFC1323:FreeBSD 4.6-4.8 (no RFC1323)

```

57344:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.6-4.9::FreeBSD 4.6-4.9

32768:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.8-4.11::FreeBSD 4.8-5.1 (or MacOS X)
32768:64:1:60:M*,N,W0,N,N,T: FreeBSD:5.0-5.1::FreeBSD 4.8-5.1 (or MacOS X)
65535:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.8-4.11::FreeBSD 4.8-5.2 (or MacOS X)
65535:64:1:60:M*,N,W0,N,N,T: FreeBSD:5.0-5.2::FreeBSD 4.8-5.2 (or MacOS X)
65535:64:1:60:M*,N,W1,N,N,T: FreeBSD:4.7-4.11::FreeBSD 4.7-5.2
65535:64:1:60:M*,N,W1,N,N,T: FreeBSD:5.0-5.2::FreeBSD 4.7-5.2

XXX need quirks support
65535:64:1:60:M*,N,W0,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (1)
65535:64:1:60:M*,N,W1,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (2)
65535:64:1:60:M*,N,W2,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (3)
65535:64:1:44:M*:Z:FreeBSD:5.2::FreeBSD 5.2 (no RFC1323)

16384:64:1:60:M*,N,N,N,N,N,N,T:FreeBSD:4.4:noTS:FreeBSD 4.4 (w/o timestamps)

----- NetBSD -----

16384:64:0:60:M*,N,W0,N,N,T: NetBSD:1.3::NetBSD
1.3
65535:64:0:60:M*,N,W0,N,N,T0: NetBSD:1.6:opera:NetBSD 1.6 (Opera)
16384:64:0:60:M*,N,W0,N,N,T0: NetBSD:1.6::NetBSD 1.6
16384:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6:df:NetBSD 1.6 (DF)
65535:64:1:60:M*,N,W1,N,N,T0: NetBSD:1.6::NetBSD 1.6W-current (DF)
65535:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6::NetBSD 1.6X (DF)
32768:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6:randomization:NetBSD 1.6ZH-current (w/ ip_id randomization)

----- OpenBSD -----

16384:64:0:60:M*,N,W0,N,N,T: OpenBSD:2.6::NetBSD 1.3 (or OpenBSD 2.6)
16384:64:1:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.8::OpenBSD 3.0-4.8
16384:64:0:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.8:no-df:OpenBSD 3.0-4.8 (scrub no-df)
57344:64:1:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.3-4.0::OpenBSD 3.3-4.0
57344:64:0:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.3-4.0:no-df:OpenBSD 3.3-4.0 (scrub no-df)

65535:64:1:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.0:opera:OpenBSD 3.0-4.0 (Opera)

16384:64:1:64:M*,N,N,S,N,W3,N,N,T: OpenBSD:4.9::OpenBSD
4.9
16384:64:0:64:M*,N,N,S,N,W3,N,N,T: OpenBSD:4.9:no-df:OpenBSD 4.9 (scrub no-df)

16384:64:1:64:M*,N,N,S,N,W6,N,N,T: OpenBSD:6.1::OpenBSD 6.1
16384:64:0:64:M*,N,N,S,N,W6,N,N,T: OpenBSD:6.1:no-df:OpenBSD 6.1 (scrub no-df)

----- DragonFly BSD -----

57344:64:1:60:M*,N,W0,N,N,T: DragonFly:1.0:A:DragonFly 1.0A

```

57344:64:0:64:M\*,N,W0,N,N,S,N,N,T: DragonFly:1.2-1.12::DragonFly 1.2-1.12  
5840:64:1:60:M\*,S,T,N,W4: DragonFly:2.0-2.1::DragonFly 2.0-2.1  
57344:64:0:64:M\*,N,W0,N,N,S,N,N,T: DragonFly:2.2-2.3::DragonFly 2.2-2.3  
57344:64:0:64:M\*,N,W5,N,N,S,N,N,T: DragonFly:2.4-2.7::DragonFly 2.4-2.7

# ----- Solaris -----

S17:64:1:64:N,W3,N,N,T0,N,N,S,M\*: Solaris:8:RFC1323:Solaris 8 RFC1323  
S17:64:1:48:N,N,S,M\*: Solaris:8::Solaris 8  
S17:255:1:44:M\*: Solaris:2.5-2.7::Solaris 2.5 to 7

S6:255:1:44:M\*: Solaris:2.6-2.7::Solaris 2.6 to 7  
S23:255:1:44:M\*: Solaris:2.5:1:Solaris 2.5.1  
S34:64:1:48:M\*,N,N,S: Solaris:2.9::Solaris  
9  
S44:255:1:44:M\*: Solaris:2.7::Solaris 7

4096:64:0:44:M1460: SunOS:4.1::SunOS 4.1.x

S34:64:1:52:M\*,N,W0,N,N,S: Solaris:10:beta:Solaris 10 (beta)  
32850:64:1:64:M\*,N,N,T,N,W1,N,N,S: Solaris:10::Solaris 10 1203

# ----- IRIX -----

49152:64:0:44:M\*: IRIX:6.4::IRIX 6.4  
61440:64:0:44:M\*: IRIX:6.2-6.5::IRIX 6.2-6.5  
49152:64:0:52:M\*,N,W2,N,N,S: IRIX:6.5:RFC1323:IRIX 6.5 (RFC1323)  
49152:64:0:52:M\*,N,W3,N,N,S: IRIX:6.5:RFC1323:IRIX 6.5 (RFC1323)

61440:64:0:48:M\*,N,N,S: IRIX:6.5:12-21:IRIX 6.5.12 - 6.5.21  
49152:64:0:48:M\*,N,N,S: IRIX:6.5:15-21:IRIX 6.5.15 - 6.5.21

49152:60:0:64:M\*,N,W2,N,N,T,N,N,S: IRIX:6.5:IP27:IRIX 6.5 IP27

# ----- Tru64 -----

32768:64:1:48:M\*,N,W0: Tru64:4.0::Tru64 4.0 (or OS/2 Warp 4)  
32768:64:0:48:M\*,N,W0: Tru64:5.0::Tru64 5.0  
8192:64:0:44:M1460: Tru64:5.1:noRFC1323:Tru64 6.1 (no RFC1323) (or QNX 6)  
61440:64:0:48:M\*,N,W0: Tru64:5.1a:JP4:Tru64 v5.1a JP4 (or OpenVMS  
7.x on Compaq 5.x stack)

# ----- OpenVMS -----

6144:64:1:60:M\*,N,W0,N,N,T: OpenVMS:7.2::OpenVMS 7.2 (Multinet 4.4 stack)

# ----- MacOS -----

```
XXX Need EOL tcp opt support
S2:255:1:48:M*,W0,E::MacOS:8.6 classic

XXX some of these use EOL too
16616:255:1:48:M*,W0: MacOS:7.3-7.6:OTTCP:MacOS 7.3-8.6 (OTTCP)
16616:255:1:48:M*,W0: MacOS:8.0-8.6:OTTCP:MacOS 7.3-8.6 (OTTCP)
16616:255:1:48:M*,N,N,N: MacOS:8.1-8.6:OTTCP:MacOS 8.1-8.6 (OTTCP)
32768:255:1:48:M*,W0,N: MacOS:9.0-9.2::MacOS 9.0-9.2
65535:255:1:48:M*,N,N,N,N: MacOS:9.1::MacOS 9.1 (OT 2.7.4)
```

```
----- Windows -----
```

```
Windows TCP/IP stack is a mess. For most recent XP, 2000 and
even 98, the patchlevel, not the actual OS version, is more
relevant to the signature. They share the same code, so it would
seem. Luckily for us, almost all Windows 9x boxes have an
awkward MSS of 536, which I use to tell one from another
in most difficult cases.
```

```
8192:32:1:44:M*: Windows:3.11::Windows
3.11 (Tucows)
S44:64:1:64:M*,N,W0,N,N,T0,N,N,S: Windows:95::Windows 95
8192:128:1:64:M*,N,W0,N,N,T0,N,N,S: Windows:95:b:Windows 95b
```

```
There were so many tweaking tools and so many stack versions for
Windows 98 it is no longer possible to tell them from each other
without some very serious research. Until then, there's an insane
number of signatures, for your amusement:
```

```
S44:32:1:48:M*,N,N,S: Windows:98:lowTTL:Windows 98 (low TTL)
8192:32:1:48:M*,N,N,S: Windows:98:lowTTL:Windows 98 (low TTL)
%8192:64:1:48:M536,N,N,S: Windows:98::Windows 98
%8192:128:1:48:M536,N,N,S: Windows:98::Windows 98
S4:64:1:48:M*,N,N,S: Windows:98::Windows 98
S6:64:1:48:M*,N,N,S: Windows:98::Windows 98
S12:64:1:48:M*,N,N,S: Windows:98::Windows 98
T30:64:1:64:M1460,N,W0,N,N,T0,N,N,S: Windows:98::Windows 98
32767:64:1:48:M*,N,N,S: Windows:98::Windows 98
37300:64:1:48:M*,N,N,S: Windows:98::Windows 98
46080:64:1:52:M*,N,W3,N,N,S: Windows:98:RFC1323:Windows
98 (RFC1323)
65535:64:1:44:M*: Windows:98:noSack:Windows 98 (no sack)
S16:128:1:48:M*,N,N,S: Windows:98::Windows 98
S16:128:1:64:M*,N,W0,N,N,T0,N,N,S: Windows:98::Windows 98
S26:128:1:48:M*,N,N,S: Windows:98::Windows 98
T30:128:1:48:M*,N,N,S: Windows:98::Windows 98
```



32767:128:1:52:M\*,N,W0,N,N,S: Windows:98::Windows 98  
60352:128:1:48:M\*,N,N,S: Windows:98::Windows 98  
60352:128:1:64:M\*,N,W2,N,N,T0,N,N,S: Windows:98::Windows 98

# What's with 1414 on NT?

T31:128:1:44:M1414: Windows:NT:4.0:Windows NT 4.0 SP6a  
64512:128:1:44:M1414: Windows:NT:4.0:Windows NT 4.0 SP6a  
8192:128:1:44:M\*: Windows:NT:4.0:Windows NT 4.0 (older)

# Windows XP and 2000. Most of the signatures that were  
# either dubious or non-specific (no service pack data)  
# were deleted and replaced with generics at the end.

65535:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows 2000 SP4, XP SP1  
65535:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows 2000 SP4, XP SP1  
%8192:128:1:48:M\*,N,N,S: Windows:2000:SP2+:Windows  
2000 SP2, XP SP1 (seldom 98 4.10.2222)  
%8192:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows 2000 SP2, XP SP1 (seldom 98 4.10.2222)  
S20:128:1:48:M\*,N,N,S: Windows:2000::Windows 2000/XP SP3  
S20:128:1:48:M\*,N,N,S: Windows:XP:SP3:Windows 2000/XP SP3  
S45:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows 2000 SP4, XP SP 1  
S45:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows 2000 SP4, XP SP 1  
40320:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows 2000 SP4

S6:128:1:48:M\*,N,N,S: Windows:2000:SP2:Windows XP, 2000 SP2+  
S6:128:1:48:M\*,N,N,S: Windows:XP::Windows XP, 2000 SP2+  
S12:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows XP SP1  
S44:128:1:48:M\*,N,N,S: Windows:2000:SP3:Windows Pro SP1, 2000 SP3  
S44:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows Pro SP1, 2000 SP3  
64512:128:1:48:M\*,N,N,S: Windows:2000:SP3:Windows SP1, 2000 SP3  
64512:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows SP1, 2000 SP3  
32767:128:1:48:M\*,N,N,S: Windows:2000:SP4:Windows SP1, 2000 SP4  
32767:128:1:48:M\*,N,N,S: Windows:XP:SP1:Windows SP1, 2000  
SP4

8192:128:1:52:M\*,N,W2,N,N,S: Windows:Vista::Windows Vista/7

# Odds, ends, mods:

S52:128:1:48:M1260,N,N,S: Windows:2000:cisco:Windows XP/2000 via Cisco  
S52:128:1:48:M1260,N,N,S: Windows:XP:cisco:Windows XP/2000 via Cisco  
65520:128:1:48:M\*,N,N,S: Windows:XP::Windows XP bare-bone  
16384:128:1:52:M536,N,W0,N,N,S: Windows:2000:ZoneAlarm:Windows 2000 w/ZoneAlarm?  
2048:255:0:40:.: Windows:.NET::Windows .NET Enterprise Server

44620:64:0:48:M\*,N,N,S: Windows:ME::Windows ME no SP (?)  
S6:255:1:48:M536,N,N,S: Windows:95:winsoc2:Windows 95 winsoc 2  
32768:32:1:52:M1460,N,W0,N,N,S: Windows:2003:AS:Windows 2003 AS

```

No need to be more specific, it passes:
:128:1:48:M,N,N,S:U:-Windows:XP/2000 while downloading (leak!) XXX quirk
there is an equiv similar generic sig w/o the quirk

----- HP/UX -----

32768:64:1:44:M*: HP-UX:B.10.20::HP-UX B.10.20
32768:64:0:48:M*,W0,N: HP-UX:11.0::HP-UX 11.0
32768:64:1:48:M*,W0,N: HP-UX:11.10::HP-UX 11.0
or 11.11
32768:64:1:48:M*,W0,N: HP-UX:11.11::HP-UX 11.0 or 11.11

Whoa. Hardcore WSS.
0:64:0:48:M*,W0,N: HP-UX:B.11.00:A:HP-UX B.11.00 A (RFC1323)

----- RiscOS -----

We don't yet support the ?12 TCP option
#16384:64:1:68:M1460,N,W0,N,N,T,N,N,?12: RISCOS:3.70-4.36::RISC OS 3.70-4.36
12288:32:0:44:M536: RISC OS:3.70:4.10:RISC OS 3.70 inet 4.10

XXX quirk
4096:64:1:56:M1460,N,N,T:T: RISC OS:3.70:freenet:RISC OS 3.70 freenet 2.00

----- BSD/OS -----

Once again, power of two WSS is also shared by MacOS X with DF set
8192:64:1:60:M1460,N,W0,N,N,T: BSD/OS:3.1::BSD/OS 3.1-4.3 (or MacOS X 10.2 w/DF)
8192:64:1:60:M1460,N,W0,N,N,T: BSD/OS:4.0-4.3::BSD/OS 3.1-4.3 (or MacOS X 10.2)

----- NewtonOS -----

4096:64:0:44:M1420: NewtonOS:2.1::NewtonOS 2.1

----- NeXTSTEP -----

S4:64:0:44:M1024: NeXTSTEP:3.3::NeXTSTEP 3.3
S8:64:0:44:M512: NeXTSTEP:3.3::NeXTSTEP 3.3

BeOS -----

1024:255:0:48:M*,N,W0: BeOS:5.0-5.1::BeOS 5.0-5.1

```

12288:255:0:44:M1402: BeOS:5.0::BeOS 5.0.x

# ----- OS/400 -----

8192:64:1:60:M1440,N,W0,N,N,T: OS/400:VR4::OS/400 VR4/R5

8192:64:1:60:M1440,N,W0,N,N,T: OS/400:VR5::OS/400 VR4/R5

4096:64:1:60:M1440,N,W0,N,N,T: OS/400:V4R5:CF67032:OS/400 V4R5 + CF67032

# XXX quirk

# 28672:64:0:44:M1460:A:OS/390:?

# ----- ULTRIX -----

16384:64:0:40:: ULTRIX:4.5::ULTRIX 4.5

# ----- QNX -----

S16:64:0:44:M512: QNX::QNX demodisk

# ----- Novell -----

16384:128:1:44:M1460: Novell:NetWare:5.0:Novel Netware 5.0

6144:128:1:44:M1460: Novell:IntranetWare:4.11:Novell IntranetWare 4.11

6144:128:1:44:M1368: Novell:BorderManager::Novell BorderManager ?

6144:128:1:52:M\*,W0,N,S,N,N: Novell:Netware:6:Novell Netware 6 SP3

# ----- SCO -----

S3:64:1:60:M1460,N,W0,N,N,T: SCO:UnixWare:7.1:SCO

UnixWare 7.1

S17:64:1:60:M1380,N,W0,N,N,T: SCO:UnixWare:7.1:SCO UnixWare 7.1.3 MP3

S23:64:1:44:M1380: SCO:OpenServer:5.0:SCO OpenServer 5.0

# ----- DOS -----

2048:255:0:44:M536: DOS:WATTCP:1.05:DOS Arachne via WATTCP/1.05

T2:255:0:44:M984: DOS:WATTCP:1.05Arachne:Arachne via WATTCP/1.05 (eeopro)

# ----- OS/2 -----

S56:64:0:44:M512: OS/2:4::OS/2 4

28672:64:0:44:M1460: OS/2:4::OS/2 Warp 4.0

# ----- TOPS-20 -----

# Another hardcore MSS, one of the ACK leakers hunted down.

# XXX QUIRK 0:64:0:44:M1460:A:TOPS-20:version 7

```

0:64:0:44:M1460: TOPS-20:7::TOPS-20 version 7

----- FreeMiNT -----

S44:255:0:44:M536: FreeMiNT:1:16A:FreeMiNT 1 patch 16A (Atari)

----- AMIGA -----

XXX TCP option 12
S32:64:1:56:M*,N,N,S,N,N,?12::AMIGA:3.9 BB2 with Miami stack

----- Plan9 -----

65535:255:0:48:M1460,W0,N: Plan9:4::Plan9 edition
4

----- AMIGAOS -----

16384:64:1:48:M1560,N,N,S: AMIGAOS:3.9::AMIGAOS 3.9 BB2 MiamiDX

#####
Appliance / embedded / other signatures
#####

----- Firewalls / routers -----

S12:64:1:44:M1460: @Checkpoint::Checkpoint (unknown 1)
S12:64:1:48:N,N,S,M1460: @Checkpoint::Checkpoint (unknown 2)
4096:32:0:44:M1460: ExtremeWare:4.x::ExtremeWare 4.x

XXX TCP option 12
S32:64:0:68:M512,N,W0,N,N,T,N,N,?12::Nokia:IPSO w/Checkpoint NG FP3
S16:64:0:68:M1024,N,W0,N,N,T,N,N,?12::Nokia:IPSO 3.7 build 026

S4:64:1:60:W0,N,S,T,M1460: FortiNet:FortiGate:50:FortiNet FortiGate 50

8192:64:1:44:M1460: Eagle::Eagle Secure Gateway

S52:128:1:48:M1260,N,N,N,N: LinkSys:WRV54G::LinkSys WRV54G VPN router

----- Switches and other stuff -----

4128:255:0:44:M*: Cisco::Cisco Catalyst 3500, 7500 etc
S8:255:0:44:M*: Cisco:12008::Cisco 12008
60352:128:1:64:M1460,N,W2,N,N,T,N,N,S: Alteon:ACEswitch::Alteon

```

ACEswitch

64512:128:1:44:M1370: Nortel:Contivity Client::Nortel Conectivity Client

# ----- Caches and whatnots -----

S4:64:1:52:M1460,N,N,S,N,W0: AOL:web cache::AOL web cache

32850:64:1:64:N,W1,N,N,T,N,N,S,M\*: NetApp:5.x::NetApp Data OnTap 5.x

16384:64:1:64:M1460,N,N,S,N,W0,N: NetApp:5.3:1:NetApp 5.3.1

65535:64:0:64:M1460,N,N,S,N,W\*,N,N,T: NetApp:5.3-5.5::NetApp 5.3-5.5

65535:64:0:60:M1460,N,W0,N,N,T: NetApp:CacheFlow::NetApp CacheFlow

8192:64:1:64:M1460,N,N,S,N,W0,N,N,T: NetApp:5.2:1:NetApp NetCache 5.2.1

20480:64:1:64:M1460,N,N,S,N,W0,N,N,T: NetApp:4.1::NetApp NetCache4.1

65535:64:0:60:M1460,N,W0,N,N,T: CacheFlow:4.1::CacheFlow CacheOS 4.1

8192:64:0:60:M1380,N,N,N,N,N,T: CacheFlow:1.1::CacheFlow CacheOS 1.1

S4:64:0:48:M1460,N,N,S: Cisco:Content Engine::Cisco Content Engine

27085:128:0:40:.: Dell:PowerApp cache::Dell PowerApp (Linux-based)

65535:255:1:48:N,W1,M1460: Inktomi:crawler::Inktomi crawler

S1:255:1:60:M1460,S,T,N,W0: LookSmart:ZyBorg::LookSmart

ZyBorg

16384:255:0:40:.: Proxyblocker::Proxyblocker (what's this?)

65535:255:0:48:M\*,N,N,S: Redline::Redline T|X 2200

32696:128:0:40:M1460: Spirent:Avalanche::Spirent Web Avalanche HTTP benchmarking engine

# ----- Embedded systems -----

S9:255:0:44:M536: PalmOS:Tungsten:C:PalmOS Tungsten C

S5:255:0:44:M536: PalmOS:3::PalmOS 3/4

S5:255:0:44:M536: PalmOS:4::PalmOS 3/4

S4:255:0:44:M536: PalmOS:3:5:PalmOS 3.5

2948:255:0:44:M536: PalmOS:3:5:PalmOS 3.5.3 (Handera)

S29:255:0:44:M536: PalmOS:5::PalmOS 5.0

16384:255:0:44:M1398: PalmOS:5.2:Clie:PalmOS 5.2 (Clie)

S14:255:0:44:M1350: PalmOS:5.2:Treo:PalmOS 5.2.1 (Treo)

S23:64:1:64:N,W1,N,N,T,N,N,S,M1460: SymbianOS:7::SymbianOS 7

8192:255:0:44:M1460: SymbianOS:6048::Symbian OS 6048 (Nokia 7650?)

8192:255:0:44:M536: SymbianOS:9210::Symbian OS (Nokia 9210?)

S22:64:1:56:M1460,T,S: SymbianOS:P800::Symbian OS ? (SE P800?)

S36:64:1:56:M1360,T,S: SymbianOS:6600::Symbian  
OS 60xx (Nokia 6600?)

# Perhaps S4?

5840:64:1:60:M1452,S,T,N,W1: Zaurus:3.10::Zaurus 3.10

32768:128:1:64:M1460,N,W0,N,N,T0,N,N,S: PocketPC:2002::PocketPC 2002

S1:255:0:44:M346: Contiki:1.1:rc0:Contiki 1.1-rc0

4096:128:0:44:M1460: Sega:Dreamcast:3.0:Sega Dreamcast Dreamkey 3.0

T5:64:0:44:M536: Sega:Dreamcast:HKT-3020:Sega Dreamcast HKT-3020 (browser disc 51027)

S22:64:1:44:M1460: Sony:PS2::Sony Playstation 2 (SOCOM?)

S12:64:0:44:M1452: AXIS:5600:v5.64:AXIS Printer Server 5600 v5.64

3100:32:1:44:M1460: Windows:CE:2.0:Windows CE 2.0

#####

# Fancy signatures #

#####

1024:64:0:40:.. \*NMAP:syn scan:1:NMAP syn scan (1)

2048:64:0:40:.. \*NMAP:syn scan:2:NMAP syn scan (2)

3072:64:0:40:.. \*NMAP:syn scan:3:NMAP syn scan (3)

4096:64:0:40:.. \*NMAP:syn scan:4:NMAP syn scan (4)

# Requires quirks support

# 1024:64:0:40:..A:\*NMAP:TCP sweep probe (1)

# 2048:64:0:40:..A:\*NMAP:TCP sweep probe (2)

# 3072:64:0:40:..A:\*NMAP:TCP sweep  
probe (3)

# 4096:64:0:40:..A:\*NMAP:TCP sweep probe (4)

1024:64:0:60:W10,N,M265,T: \*NMAP:OS:1:NMAP OS detection probe (1)

2048:64:0:60:W10,N,M265,T: \*NMAP:OS:2:NMAP OS detection probe (2)

3072:64:0:60:W10,N,M265,T: \*NMAP:OS:3:NMAP OS detection probe (3)

4096:64:0:60:W10,N,M265,T: \*NMAP:OS:4:NMAP OS detection probe (4)

32767:64:0:40:.. \*NAST:::NASTsyn scan

# Requires quirks support

# 12345:255:0:40:..A:-p0f:sendsyn utility

#####

# Generic signatures - just in case #

#####

#:64:1:60:M\*,N,W\*,N,N,T: @FreeBSD:4.0-4.9::FreeBSD 4.x/5.x

#:64:1:60:M\*,N,W\*,N,N,T: @FreeBSD:5.0-5.1::FreeBSD 4.x/5.x

\*:128:1:52:M\*,N,W0,N,N,S: @Windows:XP:RFC1323:Windows XP/2000 (RFC1323 no tstamp)

\*:128:1:52:M\*,N,W0,N,N,S: @Windows:2000:RFC1323:Windows XP/2000 (RFC1323 no tstamp)

\*:128:1:52:M\*,N,W\*,N,N,S: @Windows:XP:RFC1323:Windows XP/2000 (RFC1323 no tstamp)

\*:128:1:52:M\*,N,W\*,N,N,S: @Windows:2000:RFC1323:Windows XP/2000 (RFC1323  
no tstamp)

\*:128:1:64:M\*,N,W0,N,N,T0,N,N,S: @Windows:XP:RFC1323:Windows XP/2000 (RFC1323)

\*:128:1:64:M\*,N,W0,N,N,T0,N,N,S: @Windows:2000:RFC1323:Windows XP/2000 (RFC1323)

\*:128:1:64:M\*,N,W\*,N,N,T0,N,N,S: @Windows:XP:RFC1323:Windows XP (RFC1323, w+)

\*:128:1:48:M536,N,N,S: @Windows:98::Windows 98

\*:128:1:48:M\*,N,N,S: @Windows:XP::Windows XP/2000

\*:128:1:48:M\*,N,N,S: @Windows:2000::Windows XP/2000

Found in path(s):

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-  
xz/usr/share/xtables/pf.os

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xz/usr/share/man/man8/xtables-nft-8-gz/xtables-nft.8

\* /opt/cola/permits/1409587079\_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-  
xz/usr/share/man/man8/xtables-translate-8-gz/xtables-translate.8

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Found in path(s):

```
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-set-verdict-3-gz/ipq_set_verdict.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-set-mode-3-gz/ipq_set_mode.3
*
/opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-message-type-3-gz/ipq_message_type.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-errstr-3-gz/ipq_errstr.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/libipq-3-gz/libipq.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-read-3-gz/ipq_read.3
* /opt/cola/permits/1409587079_1683835556.5462122/0/iptables-1-1-8-3-1-x86-64-pkg-tar-
xz/usr/share/man/man3/ipq-create-handle-3-gz/ipq_create_handle.3
```

# 1.300 cglib 3.3.0

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### THE BASIC LIBRARY FUNCTIONS

-----

Written by: Philip Hazel

Email local part: ph10

Email domain: cam.ac.uk

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## 1.302 apr-util 1.6.3

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file\_io/unix/mktemp.c, strings/apr\_strings.c:

/\*

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From dso/aix/dso.c:

\* Based on libdl (dlfcn.c/dlfcn.h) which is

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From strings/apr\_strnatcmp.c, include/apr\_strings.h:

strnatcmp.c -- Perform 'natural order' comparisons of strings in C.

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From test/CuTest.c, test/CuTest.h:

```
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Written by: Philip Hazel  
Email local part: ph10  
Email domain: cam.ac.uk

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## 1.304 audit 2.8.5-2ubuntu6

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# 1.308 kmod 30

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Version 2.1, February 1999

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# 1.314 grpc 1.2.13

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## 1.315 slf4j 1.7.30

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Found in path(s):

\* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/helpers/BasicMarkerFactory.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/spi/LocationAwareLogger.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/impl/StaticLoggerBinder.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/spi/LoggerFactoryBinder.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/helpers/NOPMDCAadapter.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/helpers/BasicMDCAdapter.java  
 \*  
 /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/helpers/MarkerIgnoringBase.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/Logger.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/MDC.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/impl/StaticMarkerBinder.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/helpers/NOPLLogger.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/IMarkerFactory.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-  
 jar/org/slf4j/impl/StaticMDCBinder.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/ILoggerFactory.java  
 \* /opt/cola/permits/1512023582\_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/Marker.java  
 \*

```
/opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/helpers/NamedLoggerBase.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/LoggerFactory.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/spi/MDCAdapter.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/helpers/BasicMarker.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/helpers/SubstituteLoggerFactory.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/helpers/FormattingTuple.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/helpers/MessageFormatter.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/MarkerFactory.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-jar/org/slf4j/helpers/Util.java
*
/opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/helpers/NOPLoggerFactory.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/helpers/SubstituteLogger.java
* /opt/cola/permits/1512023582_1671282538.4353569/0/slf4j-api-1-7-30-sources-
jar/org/slf4j/spi/MarkerFactoryBinder.java
```

# 1.316 nss-pam-ldapd 0.9.11

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## 1.317 coreutils 8.30-3

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## 1.318 libpng 1.6.39

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pnm2png / png2pnm --- conversion from PBM/PGM/PPM-file to PNG-file

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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LuaFileSystem - File System Library for Lua

Copyright 2003 Kepler Project

<http://www.keplerproject.org/luafilesystem>

Description

-----

LuaFileSystem is a Lua library developed to complement the set of functions related to file systems offered by the standard Lua distribution.

LuaFileSystem offers a portable way to access the underlying directory structure and file attributes.

LuaFileSystem is free software and uses the same license as Lua 5.1

LuaRocks Installation

-----

luarocks install luafilesystem

## Documentation

-----

Please check the documentation at `doc/us/` for more information.

## History

-----

### Version 1.5.0 [20/Oct/2009]

- \* added explicit next and close methods to second return value of `lfs.dir` (the directory object), for explicit iteration or explicit closing.
- \* added directory locking via `lfs.lock_dir` function (see the manual).

### Version 1.4.2 [03/Feb/2009]

- \* fixed  
bug [#13198] `lfs.attributes(filename, 'size')` overflow on files > 2 Gb again (bug report and patch by KUBO Takehiro).
- \* fixed bug [#39794] Compile error on Solaris 10 (bug report and patch by Aaron B).
- \* fixed compilation problems with Borland C.

### Version 1.4.1 [07/May/2008]

- \* documentation review
- \* fixed Windows compilation issues
- \* fixed bug in the Windows tests (patch by Shmuel Zeigerman)
- \* fixed bug [#2185] `lfs.attributes(filename, 'size')` overflow on files > 2 Gb

### Version 1.4.0 [13/Feb/2008]

- \* added function `lfs.setmode` (works only in Windows systems).
- \* `lfs.attributes` raises an error if attribute does not exist

### Version 1.3.0 [26/Oct/2007]

- \* added function `lfs.symlinkattributes` (works only in non Windows systems).

### Version 1.2.1 [08/May/2007]

- \* compatible only with Lua 5.1 (Lua 5.0 support was dropped)

### Version 1.2 [15/Mar/2006]

- \* added optional argument to `lfs.attributes`
- \* added  
function `lfs.rmdir`
  - \* bug correction on `lfs.dir`

### Version 1.1 [30/May/2005]

\* added function lfs.touch.

Version 1.0 [21/Jan/2005]

Version 1.0 Beta [10/Nov/2004]

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## 1.323 luaposix 5.1.28

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## 1.324 luuid 1.0

### 1.324.1 Available under license :

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/\*

\* wuuid.c

\*

\* Emulation of libuuid.so API functions based on the native Windows

\* API. Only those functions actually used by luuid are provided.

\* Extending this work to a complete emulation of libuuid would be

\* possible, but of unknown value.

\*  
\* Implemented by Ross Berteig <Ross@cheshireeng.com>  
\* Released 2007-09-24.  
\* This code is hereby placed in the public domain.  
\*/

Found in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/wuuid.c

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--- This dist file is part of LuaDist project

-- status:

name="luuid"

version="5.1.0.20101118"

desc = "A library for UUID generation"

author = "Luiz Henrique de Figueiredo"

url = "http://www.tecgraf.puc-rio.br/~lhf/ftp/lua/#luuid"

license = "Public domain"

maintainer = "Peter Kapec"

dependencies = {

"lua ~> 5.1",

Linux = {

"uuid-dev >- 2.16"

}

}

Found in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/dist.info

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This is a uuid library for Lua 5.1. It generates Universally Unique Identifiers

using libuuid, which is part of the e2fsprogs package and is available at

<http://e2fsprogs.sourceforge.net/>

If you're running Linux, libuuid is probably already installed.

To try the library, just edit Makefile to reflect your installation of Lua and

possibly of libuuid. Then run make. This will build the library and run a

simple test. For detailed installation instructions, see

<http://www.tecgraf.puc-rio.br/~lhf/ftp/lua/install.html>

There is no manual but the library is simple and intuitive; see the summary

below. Read also test.lua, which shows the library in action.

This code is hereby placed in the public domain.

Please send comments, suggestions, and bug reports to [lhf@tecgraf.puc-rio.br](mailto:lhf@tecgraf.puc-rio.br) .

-----  
uuid library:  
isvalid(s) new([s]) time(s) version  
-----

#### Found

in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/README  
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# BSD license.

Found in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/FindUUID.cmake  
No license file was found, but licenses were detected in source scan.

/\*  
\* luuid.c  
\* uuid interface for Lua 5.1  
\* Luiz Henrique de Figueiredo <[lhf@tecgraf.puc-rio.br](mailto:lhf@tecgraf.puc-rio.br)>  
\* 18 Nov 2010 19:16:20  
\* This code is hereby placed in the public domain.  
\*/

Found in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/luuid.c  
No license file was found, but licenses were detected in source scan.

/\*  
\* wuuid.h  
\*  
\* Emulation of libuuid.so API functions based on the native Windows  
\* API. Only those functions actually used by luuid are provided.  
\* Extending this work to a complete emulation of libuuid would be  
\* possible, but of unknown value.  
\*  
\* Implemented by Ross Berteig <[Ross@cheshireeng.com](mailto:Ross@cheshireeng.com)>  
\* Released 2007-09-24.  
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Found in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/wuuid.h

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# Please note that the package source code is licensed under its own license.

Found in path(s):

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/CMakeLists.txt

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/lua.cmake

\* /opt/cola/permits/1547567072\_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/dist.cmake

# 1.325 isof 4.85

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\*/

/\*

\* GetOpt() -- Local get option

\*

\* Borrowed from lsof's main.c source file.

\*

\* Liberally adapted from the public domain AT&T getopt() source,

\* distributed at the 1985 UNIFORM conference in Dallas  
\*  
\* The modifications allow '?' to be an option character and allow  
\* the caller to decide that an option that may be followed by a  
\* value doesn't have one -- e.g., has a default instead.  
\*/

Found in path(s):

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/tests/LTlib.c  
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Found in path(s):

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/uw7/fs/nsc\_cfs/cnode.h  
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- \* @(#)netdb.h 5.15 (Berkeley) 4/3/91
- \*/

Found in path(s):

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/osr/include/netdb.h

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Found in path(s):

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/scripts/list\_NULf.perl5

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/scripts/shared.perl5

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/scripts/list\_fields.perl

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/scripts/idrlogin.perl

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/scripts/list\_fields.awk

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/scripts/idrlogin.perl5



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## Frequently Asked Questions about Lsof

```

| The latest release of Lsof is always available via anonymous ftp |
| from Lsof.itap.purdue.edu. Look in pub/Lsof.README for its |
| location. |

```

---

This file contains frequently asked questions about Lsof and answers to them.

Vic Abell <abe@purdue.edu>

September 27, 2011

---

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4.7 Why does exec complain it can't find libc.a[shr.o]?

4.8 What does lsof mean when it says, "TCP no PCB, CANTSENDMORE, CANTRCVMORE" in a socket file's NAME column?

4.9 When the -X option

is used on AIX 4.3.3, why does lsof disable

it, saying "WARNING: user struct mismatch; -X option disabled?"

4.10 Why doesn't the -X option work on my AIX 5L or 5.[123] system?

4.11 Why doesn't /usr/bin/oslevel report the correct AIX version?

4.11.1 Why doesn't /usr/bin/oslevel report the correct AIX version on AIX 5.1?

4.12 Why does lsof for AIX 5.1 or above Power architecture complain about kernel bit size?

4.13 What can't gcc be used to compile lsof on the ia64 architecture for AIX 5 and above?

4.14 Why does lsof get a segmentation fault when compiled with gcc for a 64 bit Power architecture AIX 5.1 kernel?

4.15 Why does lsof ignore AFS on my AIX system?

4.16 Why does lsof report "system paging space is low" and exit?

4.17 Why does lsof have compilation and execution problems on AIX 5.3 above maintenance level 1?

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5.1 What do /dev/kmem-based and libproc-based mean?

5.2 /dev/kmem-based Apple Darwin Questions

5.2.1 Why does Configure ask for a path to

the Darwin XNU kernel

header files?

5.2.1.1 Why does Configure complain that Darwin XNU kernel header files are missing?

5.2.2 Why doesn't Apple Darwin lsof report text file information?

5.2.3 Why doesn't Apple Darwin lsof support IPv6?

5.2.4 Why does lsof complain about a mismatch between the release

for which lsof was compiled and the booted Mac OS X release?

5.2.5 Why does lsof for Apple Darwin 8 and higher report

"stat(...): ..." in the NAME column?

5.2.6 What are the limitations of Apple Darwin lsof link count reporting?

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6.0 BSD/OS BSDI Problems

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7.0 DEC OSF/1, Digital UNIX, and Tru64 UNIX Problems

7.1 Why does lsof complain about non-existent /dev/fd entries?

7.2 Why does the Digital UNIX V3.2 ld complain about Ots\* symbols?

7.3 Why can't lsof locate named pipes (FIFOs) under V3.2?

7.4 Why does lsof use the wrong configuration header files?

For example, why can't the lsof compilation find cpus.h?

7.5 Why

does lsof indicate incomplete paths with "--" for Tru64

UNIX 5.1 files?

7.6 Why doesn't lsof report link count, node number, and size for some Tru64 5.x CFS files?

7.7 Why does lsof say it can't read the kernel name list or proc table on Digital UNIX 4.x or Tru64 UNIX?

8.0 FreeBSD Problems

8.1 Why doesn't lsof report on open kernfs files?

8.2 Why doesn't lsof work on my FreeBSD system?

8.3 Why doesn't lsof work on the RELEASE version of CURRENT?

8.4 Why can't kvm\_open() can't find some file?

8.5 FreeBSD ZFS Problems

8.5.1 Why does FreeBSD lsof report "WARNING: no ZFS support has been

8.6 Why can't Configure create lsof\_owner.h for FreeBSD 6 and above?

8.6.1 Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?

8.6.2 Why don't /usr/src/sys/sys/lockf.h and /usr/include/sys/lockf.h match?

9.0 HP-UX Problems

9.1 What do /dev/kmem-based and PSTAT-based mean?

9.2 /dev/kmem-based HP-UX lsof Questions

9.2.1 Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?

9.2.2 Why doesn't the /dev/kmem-based CCITT support work under 10.x?

9.2.3 Why can't /dev/kmem-based lsof be compiled with `cc -Aa` or `gcc -ansi` under HP-UX 10.x?

9.2.4 Why does /dev/kmem-based lsof complain about no C compiler?

9.2.5 Why does Configure complain about q4 for /dev/kmem-based lsof for HP-UX 11?

- 9.2.6 When compiling /dev/kmem-based lsof for HP-UX 11 what do the "aCC runtime: ERROR..." messages mean?
- 9.2.7 Why doesn't /dev/kmem-based lsof for HP-UX 11 report VxFS file link counts, node numbers, and sizes correctly?
- 9.2.8 Why can't /dev/kmem-based lsof be built with gcc for 64 bit HP-UX 11?
  - 9.2.8.1 How can I acquire a gcc for building lsof for 64 bit HP-UX 11?
- 9.2.9 Why does /dev/kmem-based lsof for HP-UX 11 report "unknown file system type" for VxFS files?
- 9.2.10 Why does the ANSI-C compiler complain about comments in HP-UX 11 header files?
- 9.2.11 Why does dnodel.c cause the HP-UX 11 compiler to complain that <sys/fs/vx\_inode.h> is missing or incorrect?
- 9.3 PSTAT-based HP-UX lsof Questions
  - 9.3.1 Why does PSTAT-based lsof complain about pst\_static and other PSTAT structures?
  - 9.3.2 Why does PSTAT-based lsof complain it can't read pst\_\* structures?
  - 9.3.3 Why does PSTAT-based lsof rebuild the device cache file after each reboot?
  - 9.3.4 Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?
  - 9.3.5 Why does PSTAT-based lsof cause an HP-UX 11.11 kernel panic?
  - 9.3.6 Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?
  - 9.3.7 Why do some swinstall packages for PSTAT-based HP-UX 11.11 packages complain about setgid and setuid bits?
  - 9.3.8 Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?
  - 9.3.9 Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?
  - 9.3.10 Why does PSTAT-based lsof complain, "FATAL: pst\_stream\_size should be: 672; is 72" on HP-UX 11.11 and above?
- 9.4 Why won't the HP-UX depot install?

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### 10.1 What

do /dev/kmem-based and /proc-based lsof mean?

### 10.2 /proc-based Linux lsof Questions

- 10.2.1 Why doesn't /proc-based lsof report file offsets (positions)?
- 10.2.2 Why does /proc-based lsof report "can't identify protocol" for some socket files?
- 10.2.3 Why does /proc-based lsof warn about unsupported formats?
- 10.2.4 Why does /proc-based lsof report "(deleted)" after a path name?
- 10.2.5 Why doesn't /proc-based lsof report full open file information for all processes?
- 10.2.6 Why won't Customize offer to change HASDCACHE or WARNDEVACCESS for /proc-based lsof?

- 10.2.7 /proc-based lsof Linux NFS questions
  - 10.2.7.1 Why can't lsof find files on an accessible NFS file system?
  - 10.2.7.2 Why can't lsof find files on an inaccessible NFS file system?
- 10.2.8 Why doesn't /proc-based Linux lsof report socket options and values, socket state flags, and TCP options and values?
- 10.2.9 Does /proc-based Linux lsof use a device cache?
- 10.2.10 Why doesn't /proc-based Linux lsof report any or all file structure values for its +fcfgGn option?
- 10.3 Special Linux file types
  - 10.3.1 Why is ``DEL" reported as a Linux file type?
  - 10.3.2 Why is ``unknown" reported as a Linux file type?
- 10.4 Linux ``mem" Entry Problems
  - 10.4.1 What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?
  - 10.4.2 Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?
- 10.5 Special Linux NAME column messages
  - 10.5.1 What does ``(stat: xxx)" mean in the NAME column of Linux files?
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- 10.6 Why is ``NOFD" reported as a Linux file type?
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- 10.8 Linux /proc/net/tcp\* and /proc/net/udp\* issues
  - 10.8.1 Why use the Linux -X option?
  - 10.8.2 Why does lsof say ``-i is useless when -X is specified"?
  - 10.8.3 Why does lsof say ``can't identify protocol (-X specified)"?
- 11.0 NetBSD Problems
  - 11.1 Why doesn't lsof report on open kernfs files?
  - 11.2 Why doesn't lsof report on open files on: file descriptor file systems; /proc file systems; 9660 (CD-ROM) file systems; MS-DOS (floppy disk) file systems; or kernel file systems?
  - 11.3 Why does lsof produce confusing results for nullfs file systems?
  - 11.4 NetBSD header file problems
    - 11.4.1 Why can't the compiler find some NetBSD header files?
    - 11.4.2 Why does NetBSD lsof produce incorrect output?
  - 11.5 Why isn't lsof feature xxx enabled for NetBSD?
- 12.0 NEXTSTEP and OPENSTEP Problems
  - 12.1 Why can't lsof report on 3.1 lockf() or fcntl(F\_SETLK) locks?
  - 12.2 Why doesn't lsof compile for NEXTSTEP with AFS?



## 13.0 OpenBSD Problems

13.1 Why doesn't lsof support kernfs on my OpenBSD system?

13.2 Will lsof work on OpenBSD on non-x86-based architectures?

13.3 <sys/pipe.h> problems

13.3.1 Why does the compiler claim nbpg isn't defined?

13.3.2 What value should I assign to nbpg?

13.4 Why doesn't lsof report on open MS-DOS file system (floppy disk)

files?

13.5 Why isn't lsof feature xxx enabled for OpenBSD?

## 14.0 Output problems

14.1 Why do the lsof column sizes change?

14.2 Why does the offset have ``0t' and ``0x" prefixes?

14.3 What are the values printed in the FILE\_FLAG column and why is 0x<value> sometimes included?

14.3.1 Why doesn't lsof display FILE\_FLAG values for my dialect?

14.4 Network Addresses

14.4.1 Why does lsof's -n option cause IPv4 addresses, mapped to IPv6, to be displayed in IPv6 notation?

14.5 Why does lsof output \x, ^x, or \xnn for characters sometimes?

14.5.1 Why is space considered a non-printable character in command names?

14.6 Why doesn't lsof print all the characters of a command name?

14.7 Why does lsof reject some -c command names, saying their lengths are "> what system provides (nn)"?

14.8 Why does lsof sometimes print TYPE numbers instead of names?

14.9 Marker line format problems

14.9.1 Why won't lsof accept a marker line format?

14.9.2 Why does lsof reject the NL (%n) marker line format?

14.10 How

are protocol state name exclusion and inclusion used?

14.10.1 Why doesn't my dialect support state name exclusion and inclusion?

## 15.0 Pyramid Version Problems

15.0.5 Statement of deprecation

## 16.0 SCO Problems

16.1 SCO OpenServer Problems

16.1.1 How can I avoid segmentation faults when compiling lsof?

16.1.2 Where is libsocket.a?

16.1.3 Why do I get "warning C4200" messages when I compile lsof?

16.2 SCO|Caldera UnixWare Problems

16.2.1 Why doesn't lsof compile on my UnixWare 7.1.1 or above system?

16.2.2 Why does lsof complain about node\_self() on my UnixWare 7.1.1 or above system?

- 16.2.3 Why does UnixWare 7.1.1 or above complain about -lcluster, node\_self(), or libcluster.so?
- 16.2.4 Why does UnixWare 7.1.1 or above lsof complain it can't read the kernel name list?
- 16.2.5 Why doesn't lsof report link count, node number, and size for some UnixWare 7.1.1 or above CFS files?
- 16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?
- 16.2.7 Why doesn't lsof report the UnixWare 7.1.1 NonStop Cluster (NSC) node a process is using?
- 16.2.8 Why does the compiler complain about missing UnixWare 2.1[.x] header files?

## 17.0 Sun Problems

- 17.0.5 Statement of deprecation
- 17.1 My Sun gcc-compiled lsof doesn't work -- why?
- 17.2 How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?
- 17.3 Why does Solaris Sun C complain about system header files?
- 17.4 Why doesn't lsof work under my Solaris 2.4 system?
- 17.5 Where are the Solaris header files?
- 17.6 Where is the Solaris /usr/src/uts/<architecture>/sys/machparam.h?
- 17.7 Why does Solaris lsof say "can't read proc table"?
- 17.8 Why does Solaris lsof complain about a bad cached clone device?
- 17.9 Why doesn't Solaris make generate .o files?
- 17.10 Why does lsof report some Solaris 2.3 and 2.4 lock types as `N`?
- 17.11 Why does lsof Configure say "WARNING: no cc in ..."?
- 17.12 Solaris 7, 8 and 9 Problems
  - 17.12.1 Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?
  - 17.12.2 Why does Solaris 7, 8 or 9 lsof say "FATAL: lsof was compiled for..."?
  - 17.12.3 How do I build lsof for a 64 bit Solaris kernel under a 32 bit Solaris kernel?
  - 17.12.4 How do I install lsof for Solaris 7, 8 or 9?
  - 17.12.5 Why does my Solaris 7, 8 or 9 system say it cannot execute lsof?
  - 17.12.6 What gcc will produce 64 bit Solaris 7, 8 and 9 executables?
  - 17.12.7 Why does lsof on my Solaris 7, 8 or 9 system say, "can't read namelist from /dev/ksyms"?
- 17.13 Solaris and COMMON
  - 17.13.1 What does COMMON mean in the NAME column for a Solaris VCHR file?
  - 17.13.2 Why does a COMMON Solaris VCHR file sometimes seem to have an incorrect minor device number?
- 17.14 Why don't lsof and Solaris pfiles reports always match?

- 17.15 Why does lsof say, "kvm\_open(namelist=default, core=default): Permission denied?"
- 17.16 Why is lsof slow on my busy Solaris UFS file system?
- 17.17 Why is lsof so slow on my Solaris 8 or 9 system?
- 17.18 Solaris and VxFS
  - 17.18.1 Why doesn't lsof support VxFS 3.4 on Solaris 2.6, and above?
  - 17.18.2 Why does lsof report "vx\_inode: vxfsu\_get\_iooffsets error" for open Solaris 2.6 and above VxFS 3.4 and above files?
  - 17.18.3 Why does Solaris Configure claim there is no VxFS library?
  - 17.18.4 Why doesn't Solaris lsof report VxFS path name components?
  - 17.18.5 Why does Solaris 10 lsof report scrambled VxFS paths?
- 17.19 Large file problems
  - 17.19.1 Why does lsof complain it can't stat(2) a Solaris 2.5.1 large file?
- 17.20 Why does lsof get a segmentation fault on 64 bit Solaris 8 using NIS+?
- 17.21 Will lsof crash the Solaris kernel?
- 17.22 Why does lsof on Solaris 7, 8, or 9 report a kvm\_open() failure?
- 17.23 Solaris and SAM-FS
  - 17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?
  - 17.23.2 Why can't lsof locate named SAM-FS files?
- 17.24 Lsof and Solaris 10 zones
  - 17.24.1 How can I make lsof list the Solaris zone?
  - 17.24.2 Why doesn't lsof work in a Solaris 10 zone?
  - 17.24.3 Why does lsof complain it can't stat() Solaris 10 zone file systems?
- 17.25 Solaris 10 problems
  - 17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?
  - 17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?
  - 17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?
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- 17.26 Solaris contract file problems
  - 17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?
  - 17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?
- 17.27 Solaris 10 ZFS problems
  - 17.27.1 Why does Configure ask for the location of ZFS header files?
  - 17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS structure definitions?
  - 17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?
- 17.28 Problems with Solaris 9 and above

17.28.1 Why does the compiler complain about `lgrp_root` on Solaris 9 and above?

## 18.0 Lsof Features

### 18.1 Why

doesn't lsof doesn't report on `/proc` entries on my system?

18.2 How do I disable the device cache file feature or alter it's behavior?

18.2.1 What's the risk with a perverted device cache file?

18.2.2 How do I put the full host name in a personal device cache file path?

18.2.3 How do I put the personal device cache file in `/tmp`?

18.3 Why doesn't lsof know about AFS files on my favorite dialect?

18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?

---

## 1.0 General Concepts

### 1.1 Lsof -- what is it?

Lsof is a UNIX-specific tool. Its name stands for LiSt Open Files, and it does just that. It lists information about files that are open by the processes running on a UNIX system.

See the lsof man page, the `00DIST` file, the `00QUICKSTART` file, and the `00README` file of the lsof distribution for more information.

### 1.2 Where do I get lsof?

Lsof is available via anonymous ftp from `lsof.itap.purdue.edu`. Look in the `pub/tools/unix/lsof` sub-directory.

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof`

Bzip2'd, compressed and gzip'd tar files with GPG certificates are available.

#### 1.2.1 Are there mirror sites?

On April 28, 2009 these sites appeared to have the latest lsof revision:

ftp://ftp.fu-berlin.de/pub/unix/tools/lsof  
ftp://sunsite.ualberta.ca/pub/Mirror/lsof

### 1.2.2 Are lsof executables available?

Some lsof executables are available in the subdirectory tree pub/tools/unix/lsof/binaries. These are neither guaranteed to be current nor cover every dialect and machine architecture.

I don't recommend you use pre-compiled lsof binaries; I recommend you obtain the sources and build your own binary. Even if you're a Sun user without a Sun C compiler, you can use gcc to compile lsof.

If you must use a binary file, please be conscious of the security and configuration implications in using an executable of unknown or different origin. The lsof binaries are accompanied by GPG certificates. Please use them!

Three additional cautions apply to executables:

1. Don't try to use an lsof executable, compiled for one version of a UNIX dialect, on another. Patches can make the dialect version different.
2. If you want to use an lsof binary on multiple systems, they must be running the same dialect OS version and have the same patches and feature support.

### 1.2.3 How do I check the validity of an lsof distribution?

There are two ways to check the validity of an lsof distribution:

1. Follow the instructions in the CHECKSUMS\_<revision> file found with the lsof distribution.

Checking with GPG is the best method.

2. Follow the instructions in the "Security" section of the README.lsof\_<revision> file found inside the lsof distribution.

Again, checking with GPG is the best method.

### 1.2.4 Why can't I get the sum(1) result reported

in  
README.lsof\_<revision>?

The "Security" section of the README.lsof\_<revision> file found inside the lsof distribution gives md5, sum, and GPG certificate information.

The simplest, the sum(1) signature, seems to be the trickiest. That's because there are different sum(1) methods, BSD systems usually have cksum(1) instead of sum(1), and different systems compute the block size value differently.

First, the lsof sum results are computed with the old, "alternate" algorithm. On newer systems, you can use sum's "-r" option to get that computation result.

Second, on BSD systems you usually must use cksum(1) instead of sum(1), because they have no sum(1). To tell cksum(1) to use the old, "alternate" algorithm, use its "-o1" option.

Third, the second value that sum reports, the block count, may be computed differently on different systems -- usually block size is considered to be 512 or 1,024. The lsof block counts were computed on a system with a sum(1) option that considers block size to be 512. The BSD system cksum(1) -o1 option considers block size to be 1,024. If your sum(1) or cksum(1) doesn't report a block count that matches the sum(1) signature given in README.lsof\_<revision>, check its man page to see what block size it uses, then adjust its reported block count appropriately.

#### 1.2.5 Why won't gpg accept the lsof-signing PGP public key?

An older PGP key that once signed lsof distributions is included in lsof revisions prior to 4.70. The PGP key is indeed my key, but is incompatible with GPG. It was created about ten years ago and is still acceptable to PGP versions 2.6.2 through 6.5.2.

Lsof revisions 4.70 and above are signed with a copy of my PGP key that has been made acceptable for use with GPG by importing it under GPG's "--allow-non-selfsigned-uid" option.

You can find my GPG compatible key in lsof revisions 4.70 and above and at:

[ftp://lsof.itap.purdue.edu/pub/Victor\\_A\\_Abell.gpg](ftp://lsof.itap.purdue.edu/pub/Victor_A_Abell.gpg)

If you have an older  
lsf revision with my PGP key, there are  
two possible ways to use it:

\* Use it with a PGP version from 2.6.2 through 6.5.2.

\* Use GPG's "--allow-non-selfsigned-uid" option when you  
import my PGP key into your GPG key ring.

```
$ gpg --allow-non-selfsigned-uid --import Victor_A_Abell.pgp
```

### 1.3 Where can I get more lsf documentation?

A significant set of documentation may be found in the lsf  
distribution (See "Where can I get lsf?"). There is a  
manual page, copious documentation in files whose names  
begin with 00, and a copy of this FAQ in the file 00FAQ  
(perhaps slightly less recent than this file if you're  
reading it via a web browser.)

Two URLs provide some documentation that appears in the  
lsf distribution:

FAQ: <ftp://lsf.itap.purdue.edu/pub/tools/unix/lsf/FAQ>

man page: [ftp://lsf.itap.purdue.edu/pub/tools/unix/lsf/lsf\\_man](ftp://lsf.itap.purdue.edu/pub/tools/unix/lsf/lsf_man)

### 1.4 How do I report an lsf bug?

If you believe you have discovered a bug in lsf, you can  
report it via e-mail to <[abe@purdue.edu](mailto:abe@purdue.edu)>.

Do NOT report lsf  
bugs to the UNIX dialect vendor. Make sure "lsf" appears in  
the "Subject:" line so my e-mail filter won't classify your  
letter as Spam.

Before you send me a bug report, please read the "Bug Reports"  
section of the 00README file of the lsf distribution. It  
lists the steps you should take before and when reporting a  
suspected bug.

### 1.5 Where can I get the lsf FAQ?

This lsf FAQ is available in the file 00FAQ in the lsf  
distribution and at the URL:

<ftp://lsf.itap.purdue.edu/pub/tools/unix/lsf/FAQ>

### 1.5.1 How timely is the on-line FAQ?

The on-line FAQ is sometimes too timely. :-)

I update it as soon as new information is available. That may include information about support that won't appear in the lsof source distribution until the next revision. If you encounter something like that, please send me e-mail at <abe@purdue.edu>. I may be able to point you at a pre-release distribution that contains the support of interest. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 1.6 Is there a test suite?

Yes, as of lsof revision 4.63 there's an automated lsof test suite in the tests/ sub-directory of the lsof top-level directory.

More information on using the test suite, what it does, how to use it and how to configure it may be found in the 00TEST file of the lsof distribution. That file also explains where the test suite has been tested.

Frequently asked questions about the test suite will be asked and answered here in the FAQ. (See "Test Suite Problems.")

After lsof has been configured with the Configure script, lsof can be made and tested with:

```
$ make
$ cd tests
$ make
```

Under normal conditions -- i.e., unless the lsof tree has been cleaned or purged severely -- all tests or individual tests may be run by:

```
$ cd test
$ make
or
$ <run a single test> (See 00TEST.)
```

### 1.7 Is lsof vulnerable to the standard I/O descriptor attack?



Lsof revisions 4.63 and above are not vulnerable.

Lsof revisions 4.62 and below are vulnerable, but no damage scenarios have so far been demonstrated.

The standard I/O descriptor attack is a local programmed assault on `setuid` and `setgid` programs that tricks them into opening a sensitive file with write access on a standard descriptor, usually `stderr` (2), and writing error messages to `stderr`. If the attacker can control the content of the error message, the attacker may gain elevated privileges.

The attack was first described in Pine Internet Advisory PINE-CERT-20020401, available at:

<http://www.pine.nl/advisories/pine-cert-20020401.txt>

If you are using an lsof revision below 4.63, you should remove any `setuid` or `setgid` permissions you might have given its executable. Then you should upgrade to lsof revision 4.63.

1.8 Can I alter lsof's `make(1)` behavior?

Yes. There are at least two ways to do that.

You can put replacements for lsof Makefile strings in your environment. If you specify the `-e` make option, make will give environment variable values precedence over strings from the Makefile. For example, to change the compiler string `CC` from the environment, you might do this with the Bourne shell:

```
$ CC=foobar; export CC
$ make -e
```

You can also replace lsof Makefile strings in the make command invocation. Here's the previous example done that way:

```
$ make CC=foobar
```

Changing the `CFGF`, `CFGL`, and `DEBUG` strings used in lsof Makefiles, either from the environment or from the make invocation, can significantly alter lsof `make(1)` behavior.

I commonly use `DEBUG` to change the `-O` option to `-g` so I can build an lsof executable for debugging -- e.g.,

```
$ make DEBUG=-g
```

(Look for DEBUG in this FAQ for other examples of its use.)

Consult the Makefiles to see what CFGL, CFGL, and other Isov Makefile strings contain, and to see what influence their alteration might have on Isov make(1) behavior.

1.9 Is there an Isov license?

No.

The only restriction on the use or redistribution of Isov is contained in this copyright statement, found in every Isov source file. (The copyright year in or format of the notice may vary slightly.)

```
/*
 * Copyright 2002 Purdue Research Foundation, West Lafayette,
 * Indiana 47907. All rights reserved.
 *
 * Written by Victor A. Abell
 *
 * This software is not subject to any license of the American
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 *
 * 4. This notice may not be removed or altered.
 */
```

## 1.10 Language locale support

### 1.10.1 Does lsof support language locales? How do I use the support?

Most UNIX dialect versions of lsof support 8 bit language locale characters -- e.g., the ability to print 8 bit characters that have accents and other marks over them.

See the answer to the "Does lsof support wide characters in language locales?" question for information on when lsof's language locale support covers characters wider than 8 bits.

To see if lsof supports language locales for your dialect, look in the dialect's machine.h header file for the HASSETLOCALE definition. If it is present and not disabled, then lsof has language locale support for the dialect.

To enable lsof's language locale support, you must specify in a locale environment variable (e.g., LANG) a language locale known to your system that supports the printing of marked characters -- e.g, en\_US. (On some dialects locale(1) may be used to list the known language locales.)

Note that LANG=C and LANG=POSIX are NOT language locales that support the printing of marked characters.

If the language locale doesn't support the printing of marked characters, lsof's OUTPUT of them follows the rules for non-printable characters described in the OUTPUT section of lsof(8).

Consult your dialect's setlocale(3) man page for the names of environment variables other than LANG -- e.g., LC\_ALL, LC\_TYPE, etc. -- which may be used to define language locales.

### 1.10.2 Does lsof support wide characters in language locales?

When lsof's language locale support is enabled with the HASSETLOCALE definition, for selected dialects lsof will also print wide characters (e.g., from UTF-8) when iswprint(3) reports them to be printable.

Wide character support is available when HASWIDECHAR is defined in a dialect's machine.h header file. As of this writing on July 22, 2004, the following dialect versions have wide character

support:

AIX >= 4.3.2  
Apple Darwin >= 7.3.0  
FreeBSD >= 5.2  
HP-UX >= 11.00  
/proc-based Linux  
NetBSD >= 1.6  
SCO OpenServer >= 5.0.6  
Solaris >= 2.6  
Tru64 UNIX 5.1

#### 1.11 Are any files in the lsof distribution copyrighted?

Yes. Most files carry the copyright of the Purdue Research Foundation and may be redistributed under the terms that accompany the copyright notice. Those terms may also be found in the answer to the question, "Is there an lsof license?")

A few files carry other copyright notices. Some are BSD notices and they explain the terms under which they are included in the lsof distribution.

Those that carry vendor copyright notices have been reproduced in their original or modified forms with permission from the copyright owners. That permission is indicated in the README files that accompany the files.

#### 1.12 Are there other lsof-related resources?

There are other resources available, connected to lsof. Among them are FreeBSD and Linux packages whose products use lsof and two particularly interesting resources.

The two interesting resources are a Gnome Tool Kit (GTK) GUI for lsof and a Perl wrapper module.

The GTK GUI is called Glsof and was developed by Gnele. It can be found at:

<http://www.sourceforge.net>

The Perl wrapper module by Marc Beyer can be found at:

<http://search.cpan.org/dist/Unix-Lsof/>

#### 1.13 What does the "WARNING: unsupported dialect or version" mean?

The lsof configure script issues that message for UNIX dialects or their versions where I have been unable to test the current revision of lsof. The message doesn't mean that lsof won't work, just that I have no direct evidence that it will.

If the CONfigure script succeeds, except for the warning, try compiling lsof. If that succeeds, try the lsof test suite.

## 2.0 Lsof Ports

### 2.1 What ports exist?

The pub/lsof.README file carries the latest port information:

- AIX 5.[23] and 5.3
- FreeBSD 4.9 and 6.4 for x86-based systems
- FreeBSD 8.[02] for AMD64-based systems
- Linux 2.1.72 and above for x86-based systems
- Solaris 9, 10 and 11

In the above list the only UNIX dialects present are ones for which I test the current lsof revision. Lsof may still support unlisted dialect versions -- e.g., HP-UX 10.20, Solaris 7, etc. -- but I don't have access to systems where I could test lsof on them, so I can't claim lsof works on them. If your dialect isn't in the list, you should try building lsof on it anyway.

Lsof version 4 predecessors, versions 2 and 3, may support older version of some dialects. Contact me via e-mail at <abe@purdue.edu> if you're interested in their distributions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 2.2 What about a new port?

The 00PORTING file in the distribution gives hints on doing a port. I will consider doing a port in exchange for permanent access to a test host. I require permanent access so I can test new lsof revisions, because I will not offer distributions of dialect ports I cannot upgrade and test.

#### 2.2.1 User-contributed Ports

Sometimes I receive contributions of ports of lsof to systems where I can't test future revisions of lsof. Hence,

I don't incorporate these contributions into my lsof distribution.

However, I do make descriptions of these contributions available. You can find them in the 00INDEX and README files at:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/contrib`

Consult the 00INDEX file in the contrib/ directory for a list of the available contributions and consult README there for information on how to obtain them.

### 2.3 Why isn't there an AT&T SVR4 port?

I haven't produced an AT&T SVR4 port because I haven't seen a UNIX dialect that is strictly limited to the AT&T System V, Release 4 source code. Every one I have seen is a derivative with vendor additions.

The vendor additions are significant to lsof because they affect the internal kernel structures with which lsof does business. While some vendor derivatives of SVR4 are similar, each one I have encountered so far has been different enough from its siblings to require special source code.

If you're interested in an SVR4 version of lsof, here are some existing ports you might consider:

DC/OSx (This obsolete port is only available upon special request.)

Reliant UNIX (This obsolete port is only available upon special request.)

SCO|Caldera UnixWare (This is the most likely choice.)

Solaris

### 2.4 Why isn't there an SGI IRIX port?

Lsof support for IRIX was terminated at lsof revision 4.36, because it had become increasingly difficult for me to obtain information on the IRIX kernel structures lsof needs to access.

At IRIX 6.5 I decided the obstacles were too large for me to overcome, and I stopped supporting lsof on IRIX. I have sources to the last revision of lsof (4.36) for IRIX, but

that version of lsof does not work on IRIX 6.5 and is vulnerable to the standard I/O descriptor attack. (See the "Is lsof vulnerable to the standard I/O descriptor attack?" Q&A for more information.) Contact me to discuss obtaining those sources.

If you wish to pursue the issue, don't contact me, contact SGI. This case was opened with SGI on the subject:

Case ID: 0982584  
Category: Unix  
Priority: 30-Moderate Impact

Problem Summary:  
kernel structure header files needed for continued lsof support

Problem Description:  
Email In 07/17/98 19:09:23

## 2.5 Why does lsof's Configure script report "WARNING: unsupported dialect or version"?

lsof's Configure script issues this message when it encounters a dialect or its version that lsof once supported, but no longer does. Usually I drop support for a dialect or version when I can no longer test lsof on it.

However, it's worth trying to compile and use lsof. Be sure to run the test suite. (See the answer to the "Is there a test suite?" question for information on the test suite.)

If you have problems with an unsupported dialect or version, contact me via e-mail at <abe@purdue.edu> and I may be able to help. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 3.0 Lsof Problems

### 3.1 Configuration Problems

#### 3.1.1 Why can't Configure determine the UNIX dialect version?

The lsof Configure script uses UNIX shell commands, often in a command pipeline, to determine the UNIX dialect version. (Consult the dialect stanza in Configure to determine which

commands are used.) If Configure can't determine the dialect version, probably one of the commands is not behaving as Configure expects.

### Symptoms

of the failure include Configure warning messages and incorrect version definitions in the Makefile CFLAGS.

If you suspect that the lsof Configure script is failing to determine the dialect version correctly, try running the commands from Configure stanza one at a time. That will usually reveal the source of the problem. Be particularly mindful that the PATH environment variable can cause commands to be executed from non-standard directories.

If you can't determine the source of the problem, there is a work-around. You can supply the UNIX dialect version in the LSOF\_VSTR environment variable. Use Configure as a guide to forming what it expects in LSOF\_VSTR. There is also some information on LSOF\_VSTR in the 00XCONFIG documentation file of the lsof distribution.

## 3.2 Compilation Problems

### 3.2.1 Why does the compiler complain about missing header files?

When you use make to build lsof, the compiler may complain that it can't find header files -- e.g.,

```
$
make
(cd lib; make DEBUG="-O" CFGF="-DAIXA=0 -DAIXV=4330 \
-DLSOF_VSTR=\"4.3.3.0\"")
gcc -DAIXA=0 -DAIXV=4330 -DLSOF_VSTR="4.3.3.0" -O \
-c ckv.c
In file included from ckv.c:33: ../machine.h:70: \
sys/types.h: A file or directory in the path name \
does not exist. \
```

That type of complaint doesn't represent an lsof problem. It represents a problem with a missing system header file that probably should be found in /usr/include or in the system source tree.

As a first step try using find(1) to locate the problem header file. If it's a system header file and can't be found, here are some possible causes:



1. The file set, RPM or package containing the header files has not been installed. Instructions for doing that are specific to the UNIX dialect and beyond the scope of this document.

2. If the compiler is gcc, the private gcc header files:

- \* May not have been installed;

- \* May have been installed incorrectly;

- \* May not have been updated properly after the last compiler or system update;

- \* Ones from a previous installation may not have been removed.

A path leading to the gcc private header files can be found with ``gcc -v``. Consult the gcc documentation for instructions on proper installation of the private gcc header files.

3. On some dialects -- e.g., FreeBSD, NetBSD, OpenBSD -- lsof may need to use header files that are located in the system source tree -- /sys or /usr/src/sys, for example. Make sure the system source tree has been installed.

### 3.2.2 Why does gcc complain about the contents of header files distributed by the system's vendor?

When you use make to build lsof and gcc to compile it, gcc may complain that it finds errors in system header files

-- e.g.,

```
$ make
(cd lib; make DEBUG="-O" CFGF="-Dsolaris=80000 \
-DHASPR_GWINDOWS -m64 -DHASIPv6 -DHAS_VSOCK
\
-DLSOF_VSTR=\"5.8\"")
gcc -Dsolaris=80000 -DHASPR_GWINDOWS -m64 -DHASIPv6 \
-DHAS_VSOCK -DLSOF_VSTR="5.8" -O -c dvch.c
In file included from /usr/include/sys/proc.h:31, \
 from /homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
3.2.1/include/sys/user.h:267, from /usr/include/kvm.h:13, \
from ../dlsof.h:53, from ../lsof.h:172, from dvch.c:43: \
/homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
```

### 3.2.1/include/sys/task.h:59: parse error before "uint\_t"

Errors like the above are most likely not problems in the system's header files, but in the private copies of them that were created when gcc was made or installed. Note the presence of  
"../gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/3.2.1/include/..."  
in the paths for user.h and task.h. It indicates both header files are gcc-specific.

To solve errors like this requires comparing the header files in the vendor's /usr/include tree to the gcc-specific ones in gcc's private gcc-lib/.../include tree. It may be necessary to regenerate gcc-specific header files, correct them or remove them. See the gcc distribution for the appropriate tools.

A possible temporary work-around is to direct gcc to use the vendor's header files instead of its temporary ones by declaring -I/usr/include in the compilation flags.

### 3.2.3 Other header file problems

Don't overlook any vendor tools that might validate the vendor header files installed on the system -- e.g., the Solaris pkgchk tool can be used to check the header files that were installed from the SUNWhea package.

For other header file problems contact me at <abe@purdue.edu>. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ.

### 3.3 Why doesn't lsof report full path names?

Lsof reports the full path name when it is specified as a search argument for open files that match the argument. However, if the argument is a file system mounted-on directory, and lsof finds additional path name components from the kernel name cache, it will report them.

Lsof reports path name for file system types that have path name lookup features -- e.g., some versions of AdvFS for Digital and Tru64 UNIX. The Linux /proc-based lsof reports full path names, because the Linux /proc file system provides them. Lsof on recent builds of Solaris 10 also report full path names, because those Solaris kernels record the full path

name in the vnode structure.

Otherwise, lsof uses the kernel name cache, where it exists and can be accessed, and reports some or all path name components (e.g., the sys and proc.h components of /usr/include/sys/proc.h) for these dialects:

Apple Darwin  
DC/OSx  
FreeBSD  
HP-UX, /dev/kmem and PSTAT based  
Linux, /dev/kmem-based  
NetBSD  
NEXTSTEP  
OpenBSD  
OPENSTEP  
Reliant UNIX  
SCO OpenServer  
SCO|Caldera UnixWare  
Solaris 2.x, 7, 8 and 9 (except for some VxFS versions;

see the "Why doesn't Solaris

lsof report VxFS path name components?" section for more information)

Solaris 10 (early builds) Tru64 UNIX

As far as I can determine, AFS path lookups don't share in kernel name cache operations, so lsof can't identify open AFS path name components. Apparently Solaris VxFS versions 4 and above don't share in kernel name cache operations, either, so lsof can't display path name components for those open files.

Since the size of the kernel name cache is limited and the cache is in constant flux, it does not always contain the names of all components in an open file's path; sometimes it contains none of them.

Lsof reports the file system directory name and whatever components of the file's path it finds in the cache, starting with the last component and working backwards through the directories that contain it. If lsof finds no path components, lsof reports the file system device name instead.

When lsof does report some path components in the NAME column, it prefixes them with the file system directory name, followed by " -- ", followed by the components --

e.g., /usr -- sys/path.h for /usr/include/sys/path.h. The "--" is omitted when lsof finds all the path name components of a file's name.

The PSTAT-based HP-UX lsof relies on kernel name cache contents, too, even though its information comes to lsof via pstat() function calls. Consequently, PSTAT-based HP-UX lsof won't always report full paths, but may use the "--" partial path name notation, or may occasionally report no path name at all but just the file system mounted-on directory and device names.

Lsof can't obtain path name components from the kernel name caches of the following dialects:

#### AIX

Only the Linux kernel records full path names in the structures it maintains about open files; instead, most kernels convert path names to device and node number doublets and use them for subsequent file references once files have been opened.

To convert the device and node number doublet into a complete path name, lsof would have to start at the root node (root directory) of the file system on which the node resides, and search every branch for the node, building possible path names along the way. That would be a time-consuming operation and require access to the raw disk device (usually implying setuid-root permission).

If the prospect of all that local disk activity doesn't concern you, think about the cost when the device is NFS-mounted.

Try using the file system mount point and node number lsof reports as parameters to find -- e.g.,

```
$ find <mount_point> -inum <node_number> -print
```

and you may get an appreciation of what a file system directory tree search would cost.

#### 3.3.1 Why do lsof -r reports show different path names?

When you run lsof with its repeat ("`-r") option, you may notice that the extent to which it reports path names for

the same files may vary from cycle to cycle. That happens because other processes are making kernel calls affecting the cache and causing entries to be removed from and added to it.

### 3.3.2 Why does lsof report the wrong path names?

Under some circumstances lsof may report an incorrect path name component, especially for files in a rapidly changing directory like /tmp.

In a rapidly changing directory, like /tmp, if the kernel doesn't clear the cache entry when it removes a file, a new file may be given the same keys and lead lsof to believe that the old cache entry with the same keys belongs to the new file.

Lsof tries to avoid this error by purging duplicate entries from its copy of the kernel name cache when they have the same device and inode number, but different names.

This error is less likely to occur in UNIX dialects where the keys to the name cache are node address and possibly a capability ID. The Apple Darwin, Digital UNIX, FreeBSD, HP-UX, NEXTSTEP, OPENSTEP, Solaris, Tru64 UNIX, and UnixWare dialects use node address. Apple Darwin, FreeBSD, NetBSD, OpenBSD, Tru64 UNIX, and also use a capability ID to further identify name cache entries.

### 3.3.3 Why doesn't lsof report path names for unlinked (rm'd) files?

When lsof gets path name components from the kernel's name cache, it does not report the path names of a file that has been unlinked from its parent directory -- e.g., deleted via rm, or the unlink() system call -- even when some process may still hold the file open; lsof reports only the file system's mounted-on directory and device. That's because path name components are removed from the kernel name cache when the file is unlinked.

Unlinked open files are sometimes used by applications for temporary, but invisible storage (i.e., ls won't show them, and no other process can open them.) However, they may occasionally consume disk space to excess and cause concern for a system administrator, who will be unable to locate them with find, ls,

du, or other tools that rely on finding files by examining the directory tree.

By using lsof's +L option you can see the link count of open files -- in the NLINK column. An unlinked file will have an NLINK value of zero. By using the option +L1 you can tell lsof to display only files whose link count is less than one (i.e., zero).

There are some UNIX dialect-specific exceptions to lsof's inability to report unlinked path names. They are described in the answer to the "When will lsof report path names for deleted files?" question.

### 3.3.4 Why doesn't lsof report the "correct" hard linked file path name?

When lsof reports a rightmost path name component for a file with hard links, the component may come from the kernel's name cache. Since the key which connects an open file to the kernel name cache may be the same for each differently named hard link, lsof may report only one name for all open hard-linked files. Sometimes that will be "correct" in the eye of the beholder; sometimes it will not. Remember, the file identification keys significant to the kernel are the device and node numbers, and they're the same for all the hard linked names.

### 3.3.5 When will lsof report path names for deleted files?

Lsof will report path names for deleted files for two dialects: Linux and later builds of Solaris 10.

Deleted Linux path names are reported by default and have "(deleted)" at their ends.

The display of Solaris 10 deleted path names may be selected with the -X option. When selected they are also reported with "(deleted)" at their ends.

### 3.4 Why is lsof so slow?

Lsof may appear to be slow if network address to host name resolution is slow. This can happen, for example, when the name server is unreachable, or when a Solaris PPP cache daemon is malfunctioning.

To see if name lookup is causing lsof to be slow, turn it off with the `--n` option.

Port service name lookup or portmap registration lookup may also be causes of slow-down.

To suppress port service name lookup, specify the `--P` option.

Lsof doesn't usually make direct portmap calls -- only when `+M` is specified, or when `HASPMAPENABLED` is defined during lsof construction. (The lsof help panel, produced with `lsof -h` will display the default portmap registration reporting state.) The quickest first step in checking if lsof is slow because of the portmapper is to use lsof's `--M` option.

Lsof may be slow if UID to login name lookups are slow. Suppress them with `--l`.

On dialects where lsof uses the kernel name cache, try disabling its use with `--C`. (You can tell if lsof uses the kernel name cache by looking for `--C` in lsof's `--h` output.) Of course, disabling kernel name cache use will mean that lsof won't report full or partial path names, just file system and character device names.

If you're just interested in the open files of one process, try using the `--p <Process-ID>` option to limit lsof to that process.

(The `--p` option may also be followed with a list of Process-IDs.)

If you're interested in including or excluding certain commands, try lsof's `-c[^]cmd` option.

If you're interested in certain Internet TCP and UDP states (e.g., `ESTABLISHED`) or in excluding some (e.g., `CLOSE_WAIT`), try lsof's `-s p:s` option. More information on it may be found in the answer to the "How are protocol state name exclusion and inclusion used?" question.

Your UNIX dialect may not support `-s p:s` and its associated performance improvements to Internet-only file processing. You can find more information on those topics in the answer to the "Why doesn't my dialect support state name exclusion and inclusion?" question.

Older AIX lsof may be slow to start because of its `oslevel` identity comparison. (Newer AIX lsof uses `uname(2)`.) See the

"Why does AIX lsof start so slowly?" and "Why does lsof warn "compiled for x ... y; this is z.?" sections for more information.

### 3.5 Why doesn't

lsof's setgid or setuid permission work?

If you install lsof on an NFS file system that has been mounted with the nosuid option, lsof may not be able to use the setgid or setuid permission you give it, complaining it can't open the kernel memory device -- e.g., /dev/kmem.

The only solution is to install lsof on a file system that doesn't inhibit setgid or setuid permission.

### 3.6 Does lsof have security problems?

I don't think so. However, lsof does usually start with setgid permission, and sometimes with setuid-root permission. Any program that has setgid or setuid-root permission, should always be regarded with suspicion.

Lsof drops setgid power, holding it only while it opens access to kernel memory devices (e.g., /dev/kmem, /dev/mem, /dev/swap). That allows lsof to bypass the weaker security of access(2) in favor of the stronger checks the kernel makes when it examines the right of the lsof process to open files declared with -k and -m. Lsof also restricts some device cache file naming options when it senses the process has setuid-root power.

On a few dialects lsof requires setuid-root permission during its full execution in order to access files in the /proc file system. These dialects include:

DC/OSx 1.1 for Pyramid systems

Reliant UNIX 5.4[34] for Pyramid systems

When lsof runs with setuid-root permission it severely restricts all file accesses it might be asked to make with its options.

The device cache file (typically .lsof\_hostname in the home directory of the real user ID that executes lsof) has 0600 modes. (The suffix, hostname, is the first component of the host's name returned by gethostname(2).) However, even when lsof runs setuid-root, it makes sure the file's



ownerships are changed to that of the real user and group. In addition, lsof checks the file carefully before using it (See the question "How do I disable the device cache file feature or alter its behavior?" for a description of the checks.); discards the file if it fails the scrutiny; complains about the condition of the file; then rebuilds the file.

See the 00DCACHE file of the lsof distribution for more information about device cache file handling and the risks associated with the file.

### 3.7 Will lsof show remote hosts using files via NFS?

No. Remember, lsof displays open files for the processes of the host on which it runs. If the host on which lsof is running is an NFS server, the remote NFS client processes that are accessing files on the server leave no process records on the server for lsof to examine.

### 3.8 Why doesn't lsof report locks held on NFS files?

Generally lock information held by local processes on remote NFS files is not recorded by the UNIX dialect kernel. Hence, lsof can't report it.

One exception is some patch levels of Solaris 2.3, and all versions of Solaris 2.4 and above. Lsof for those dialects does report on locks held by local processes on remotely mounted NFS files.

#### 3.8.1 Why does lsof report a one byte lock on byte zero as a full file lock?

When a process has a lock of length one, starting at byte zero, lsof can't distinguish it from a full file lock. That's because most UNIX dialects represent both locks the same way in their file lock (flock or eflock) structures.

### 3.9 Why does lsof report different values for open files on the same file system (the automounter phenomenon)?

On UNIX dialects where file systems may be mounted by an automounter with the ``direct" type, lsof may sometimes report difference DEVICE, SIZE/OFF, INODE and NAME values when asked to report files open on the file system.

This happens because some files open on the file system -- e.g., the current directory of a shell that changed its directory to the file system as the file system's first reference -- may be characterized in the kernel with temporary automounter node information. The `cd` doesn't cause the file system to be mounted.

A subsequent reference to the file system -- e.g., an `ls` of any place in it -- will cause the file system to be mounted. Processes with files open to the mounted file system are characterized in the kernel with data that reflects the mounted file system's parameters.

Unfortunately some kernels (e.g., some versions of Solaris 2.x) don't revisit the process that did only a change-directory for the purpose of updating the data associated with the open directory file. The file continues to be characterized with temporary automounter information until it does another directory change, even a trivial `cd .`.

`Lsof` will report on both reference types, when supplied the file system name as an argument, but the data `lsof` reports will reflect what it finds in the kernel. For the different types `lsof` will display different data, including different major and minor device numbers in the `DEVICE` column, different lengths in the `SIZE/OFF` column, different node numbers in the `INODE` column, and slightly different file system names in the `NAME` column.

In contrast, `fuser`, where available, can only report on one reference type when supplied the file system name as an argument. Usually it will report on the one that is associated with the mounted file system information. If the only reference type is the temporary automounter one, `fuser` will often be silent about it.

### 3.10 Why don't `lsof` and `netstat` output match?

`Lsof` and `netstat` output don't match because `lsof` reports the network information it finds in open file system objects -- e.g., socket files -- while `netstat` often gets its information from separate kernel tables.

The information available to `netstat` may describe network activities never or no longer associated with open files,

but necessary for proper network state machine operation.

For example, a TCP connection in the FIN\_WAIT\_[12] state may no longer have an associated open file, because the connection has been closed at the application layer and is now being closed at the TCP/IP protocol layer.

### 3.10.1 Why can't lsof find accesses to some TCP and UDP ports?

Lsof stands for LiSt Open Files. If there is no open file connected to a TCP or UDP port, lsof won't find it. That's the most common reason why lsof doesn't find a port netstat might report open.

One reason I've found on some UNIX dialects is that their kernels set aside TCP and UDP ports for communicating with support activities, running in application layer servers -- the automounter daemons, and the NFS biod and nfsd daemons are examples. Netstat may report the ports are in use, but lsof doesn't.

Another reason is that netstat may also be able to report a port is open on a particular dialect, because it uses a source of data different from what lsof uses -- e.g., netstat might examine kernel tables or use streams messages to MIB2, while lsof relies on the information it finds in open file structures and their descendants.

Sometimes it's possible to search the data netstat and lsof use. For example, on Linux /proc/tcp and /proc/udp can be examined. There might an entry there for a particular protocol and port, but if the line on which the port appears doesn't have an inode number that matches an inode number of an open file, lsof won't be able to identify the process using the port.

This is a tough question to which there is no easy answer.

### 3.11 Why does lsof update the device cache file?

At the end of the lsof output you may see the message:

```
lsof: WARNING: /Homes/abe/.lsof_vic was updated.
```

In this message /Homes/abe/.lsof\_vic is the path to the private device cache file for login abe. (See 00DCACHE.)

Lsof issues this message when it finds it necessary to recheck the system device directory (e.g., /dev or /devices) and rebuild the device cache file during the open file scan. Lsof may need to do these things it finds that a device directory node has changed, or if it cannot find a device in the cache.

### 3.12 Why doesn't lsof report state for UDP socket files?

Lsof reports UDP TPI connection state -- TS\_IDLE (Idle), TS\_BOUND (Bound), etc. -- for some, but not all dialects. TPI state is stream-based TCP/IP information that isn't available in many dialects.

A fairly weak general rule is if netstat(1) reports UDP TPI state, lsof may be able to report it, too. But don't be surprised if lsof fails to report UDP TPI state for your dialect. Other factors influence lsof's ability to report UDP TPI state, including the availability of state number data in kernel structures, and state number to state name conversion data.

### 3.13 I am editing a file with vi; why doesn't lsof find the file?

Classic implementations of vi usually don't keep open the file being edited. (Newer ones may do so in order to maintain an advisory lock.) Instead classic vi opens the file, makes a temporary copy (usually in /tmp or /usr/tmp), and does its work in that file. When you save the file being edited from a classic vi implementation, it reopens and rewrites the file.

During a classic vi session, except for the brief periods when vi is reading or rewriting the file, lsof won't find an open reference to the file from the vi process, because there is none.

### 3.14 Why doesn't lsof report TCP/TPI window and queue sizes for my dialect?

Lsof only reports TCP/TPI window sizes for Solaris, because only its netstat reports them. The intent of providing TCP/TPI information in lsof NAME column output is to make it easier to match netstat output to lsof output.

In general lsof only reports queue sizes for both TCP and

UDP (TPI) connections on BSD-derived UNIX dialects, where both sets of values appear in kernel socket queue structures. SYSV-derived UNIX dialects whose TCP/IP implementations are based on streams generally provide only TCP queue sizes, not UDP (TPI) ones.

While you may find that netstat on some SYSV-derived UNIX dialects with streams TCP/IP may report UDP (TPI) queue sizes, you will probably also find that the sizes are always zero -- netstat supplies a constant zero for UDP (TPI) queue sizes to make its headers align the same for TCP and UDP (TPI) connections. Solaris seems to get it right -- i.e., its netstat does not report UDP (TPI) queue sizes.

When in doubt, I chose to avoid reporting UDP (TPI) queue sizes for UNIX dialects whose netstat-reported values I knew to be a constant zero or whose origin I couldn't determine. OSR is a dialect in this category.

### 3.14.1 Why doesn't lsof report socket options, socket states, and TCP flags and values for my dialect?

The lsof -T argument, 'f', that selects the reporting of socket options, socket states and TCP flags was implemented at lsof revision 4.71 for the following UNIX dialects, providing the indicated information:

AIX 4.3.2 and 5.1 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

Apple Darwin 7.2 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

Digital UNIX and Tru64 UNIX 4.0

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

FreeBSD 4.9 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

HP-UX 11.00 (/dev/kmem-based lsof)

All socket options and values are reported. No socket states are reported. Only the TF\_NODELAY TCP flag and the TF\_MSS value are reported.

HP-UX 11.11 and iiv2 (PSTAT-based lsof)

All socket options and values, and socket states are reported. No TCP flags or values are reported.

## Linux

No socket options and values, socket states, or TCP flags and values are reported. The support for "-Tf" could not be added to Linux, because socket options, socket states, and TCP flags and values are not available

via the /proc file system.

## NetBSD 1.6G and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

## OpenBSD 3.4 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

## OPENSTEP 4.2

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

## OpenUNIX 8

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

## SCO OpenServer Release 5.0.6

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

## Solaris 2.6, 8 and above

The socket option display is limited to BROADCAST, DEBUG, DGRAM\_ERRIND, DONTRROUTE and OOBINLINE. Socket values are limited to KEEPALIVE and LINGER. No socket states are reported. The TCP DELACK, NODELAY and SENTFIN flags are reported. The TCP MSS value is reported.

## UnixWare 7.1.[134]

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

### 3.14.2 Why doesn't lsof report the partial listen queue connection count for my dialect?

The reporting of partial listen queue connections was added to -Tf processing at lsof revision 4.76. Currently it is reported for these dialects:

#### AIX 4.3.2

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

#### AIX 5.1 and above

Partial listen queue information is available.

#### Apple Darwin 7.2 and above

Partial listen queue information is available.

Digital UNIX 4.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

FreeBSD 4.9 and above

Partial listen queue information is available.

HP-UX 11.00 (/dev/kmem-based lsof)

No partial listen queue information is available.

HP-UX

11.11 and iiiiv2 (PSTAT-based lsof)

No partial listen queue information is available.

Linux

No partial listen queue information is available.

NetBSD 1.6G and above

Partial listen queue information is available.

OpenBSD 3.4 and above

Partial listen queue information is available.

OPENSTEP 4.2

Partial listen queue information is available.

OpenUNIX 8

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

SCO OpenServer Release 5.0.6

No partial listen queue information is available.

Solaris 2.6, 8 and above

Partial listen queue information is available.

Tru64 UNIX 5.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

Tru64 UNIX 5.1

Partial listen queue information is available.

UnixWare 7.1.[134]

Partial listen queue information is available.

3.15 What does "no more information" in the NAME column mean?

When lsof can find no successor structures -- a gnode, inode, socket, or vnode -- connected to the file structure of an open descriptor of a process, it reports "no more information" in the NAME column. The TYPE, DEVICE, SIZE/OFF, and INODE columns will be blank.

Because the file structure is supposed to contain a pointer

to the next structure of a file's processing support, if the pointer is NUL, lsof can go no further.

Some UNIX dialects have file structures for system processes -- e.g., the sched process -- that have no successor structure pointers. The "no more information" NAME will commonly appear for these processes in lsof output.

It may also be the case that lsof has read the file structure while it is being assembled and before a successor structure pointer value has been set. The "no more information" NAME will again result.

Unless lsof output is filled with "no more information" NAME column messages, the appearance of a few should be no cause for alarm.

### 3.16 Why doesn't lsof find a process that ps finds?

If lsof fails to display open files for a process that ps indicates exists, there may be several reasons for the difference.

The process may be a "zombie" for which ps displays the "(defunct)" state. In that case, the process has exited and has no open file information lsof can display. It does still have a process structure, sufficient for the needs of ps.

Another possible explanation is that kernel tables and structures may have been changing when lsof looked for the process, making lsof unable to find all relevant process structures. Try repeating the lsof request.

### 3.17 Why doesn't -V report a search failure?

The usual reason that -V won't report a search failure is that lsof located the search item, but was prevented from listing it by an option that doesn't participate in search failure reporting.

For example, this lsof invocation:

```
$ lsof -V -i TCP@foobar -a -d 999
```

won't report



it can't find the Internet address TCP@foobar, even if there is an open file connected to that address, unless the open file also has a file descriptor number of 999 (the ``-a -d 999" options).

Compile-time options can also affect -V results in much the same way. For example, if HASSECURITY and HASNOSOCKSECURITY are defined at compile time, this lsof invocation, run by a non-root user:

```
$ lsof -V -c inetd
```

won't report that it can't find the inetd command, even if there is a process running the inetd command, because the HASSECURITY and HASNOSOCKSECURITY options prevent the listing of all but the socket files of another user, and no socket file selector (e.g., "-i") was specified.

### 3.18 Portmap problems

#### 3.18.1 Why isn't a name displayed for the portmap registration?

When portmap registration reporting is enabled, any time there is a registration for a local TCP or UDP port, lsof displays it in square brackets, following the port number or service name -- e.g., ``:1234[name]" or ``:name[100083]".

The TCP or UDP port number or service number (what follows the `:') is displayed under the control of the lsof -P option. The registration identity is held by the portmapper and may be a name or a number, depending on how the registration's owner declared it. lsof reports what the port map holds and cannot derive a registration name from a registration number.

lsof can be compiled with registration reporting enabled or disabled by default, under the control of the HASPMAPENABLED #define (usually in machine.h). The lsof help panel (lsof -h) will show the default. lsof is distributed with reporting disabled by default.

#### 3.18.2 How can I display only portmap registrations?

lsof doesn't have an option that will display only TCP or UDP ports with portmap registrations. The +M option only enables the reporting of registration information when

Internet socket files are displayed; +M doesn't select the displaying of Internet socket files -- the -i option does that.

This simple lsof pipe to grep will do the job:

```
$ lsof -i +M | grep "\["
```

This works because -i selects Internet socket files, +M enables portmap registration reporting, and only output lines with opening square brackets will have registrations.

When portmap registration reporting is enabled by default, because the lsof builder constructed it that way, +M is not necessary. (The lsof help panel, produced with ``lsof -h`` will display the default portmapper registration reporting state.) However, specifying +M when reporting is already enabled is acceptable, as is specifying -M when reporting is already disabled.

Digression: lsof will accept ``+'` or ``-'` as a prefix to most options. (That isn't documented in the man page or help panel to reduce confusion and complexity.) The -i option is as acceptable as +i, so the above example could be written a little more tersely as:

```
$ lsof +Mi | grep "\["
```

But be careful to use the ``Mi`` ordering, since ``iM`` implies M is an address argument to ``i``.

### 3.18.3 Why doesn't lsof report portmap registrations for some ports?

Lsof reports portmap registrations for local TCP and UDP ports only. It identifies local ports this way:

- \* The port appears in the local address section of the kernel structure that contains it.
- \* The port appears in the foreign address section of a kernel structure whose local and foreign Internet addresses are the same.
- \* The port appears in the foreign address section of a kernel address structure whose Internet address is `INADDR_LOOPBACK` (127.0.0.1).

Following these rules, lsof ignores foreign portmapped ports. That's done for reasons of efficiency and possible security prohibitions. Contacting all remote portmappers could take a long time and be blocked by network difficulties (i.e., be inefficient). Many firewalls block portmapper access for security reasons.

Lsof may occasionally ignore portmap registration information for a legitimate local port by virtue of its local port rules. This can happen when a port appears in the foreign part of its kernel structure and the local and foreign Internet addresses don't match (perhaps because they're on different interfaces), and the foreign Internet address isn't INADDR\_LOOPBACK (127.0.0.1).

### 3.19 Why is `lsof | wc` bigger than my system's open file limit?

There is a strong temptation to count open files by piping lsof output to wc. If your purpose is to compare the number you get to some Unix system parameter that defines the number of open files your system can have, resist the temptation.

One reason is that lsof reports a number of "files" that don't occupy Unix file table space -- current working directories, root directories, jail directories, text files, library files, memory mapped files are some. Another reason is that lsof can report a file shared by more than one process that itself occupies only one file table slot.

If you want to know the number of open files that occupy file table slots, use the +ff option and process the lsof output's FILE\_ADDR column information with standard Unix tools like cut, grep, sed, and sort.

You might also consider using lsof's field output with +ff, selecting the file struct address with -FF, and processing the output with an AWK or Perl script. See the list\_fields.awk, list\_fields.perl, and shared.perl5 scripts in the scripts/ subdirectory of the lsof distribution for hints on file struct post-processing filters.

### 3.20 Why doesn't lsof report file offset (position)?

Lsof won't report a file offset (position) value if the -s

option has been specified, or if the dialect doesn't support the displaying of file offset (position).

That lsof is reporting only file size is indicated by the fact that the appropriate column header says SIZE instead of SIZE/OFF.

If lsof doesn't support the displaying of file offset (position) -- e.g., for Linux /proc-based lsof -- the -h or -? output panel won't list the -o option.

Sometimes the availability of file offset information depends on the dialect's kernel. This is particularly true for socket file offsets.

Maintenance of offsets for pseudo-terminal devices varies by UNIX dialect and is related to how the dialect kernel implements pseudo-terminal support. Kernels like AIX, for example, that short-circuit the transfer of data between socket and pseudo devices to reduce TCP/IP daemon interrupt rates won't advance offsets in the TCP/IP daemon socket files. Instead they will advance offsets in the open standard I/O files of the shell child process where the pseudo-terminal devices are used.

When in doubt about the behavior of lsof in reporting file offset information, do some carefully measured experiments, consult the lsof sources, or contact me at <abe@purdue.edu> to discuss the matter. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ.

### 3.20.1 What does lsof report for size when the file doesn't really have one?

When a file has no true size -- e.g., it's a socket, a FIFO, or a pipe -- lsof tries to report the information it finds in the kernel that describes the contents of associated kernel buffers.

Thus, for example, size for most TCP/IP files is socket buffer size. The size of the socket read buffer is reported for read-only files; the size of the write buffer for write-only files; and the sum of the buffers sizes for read-write files.

### 3.21 Problems with path name arguments

### 3.21.1 How do I ask lsof to search a file system?

You can ask lsof to search for all open files on a file system by specifying its mounted path name as an lsof argument -- e.g.,

```
$ lsof /
```

Output of the mount command will show file system mounted path names. It will also show the mounted-on device path for the file system.

If the mounted-on device is a block device (the permission field in output of `ls -l <device>` starts with a `b`), you can specify its name, too -- e.g.,

```
$ lsof /dev/sd0a
```

If the mounted-on device isn't a block device -- for example, some UNIX dialects call a CD-ROM device a character device (ls output starts with a `c`) -- you can force lsof to assume that the specified device names a file system with the `+f` option -- e.g.,

```
$ lsof +f -- /dev/sd0a
```

(Note: you must use `--` after `+f` or `-f` if a file name follows immediately, because `+f` and `-f` can be followed by characters that specify flag output selections.)

When you use `+f` and lsof can't match the device to a file system, lsof will issue a complaint.

The `+f` option may be used in some dialects to ask lsof to search for an NFS file system by its server name and server mount point. If the mount application reports an NFS file system mounted-on value that way, then this sample lsof request should work.

```
$ lsof +f -- fleet:/home/fleet/u5
```

Finally, you can use `-f` if you don't want a mounted file system path name to be considered a request to report all open files on the file system. This is useful when you want to know if anyone is using the file system's mounted

path name. This example directs lsof to report on open access to the '/' directory, including when it's being used as a current working or root directory.

```
$ lsof -f -- /
```

The lsof -f option performs the same function as -f does in some fuser implementations. However, since the lsof -c option was chosen for another purpose before the -f option was added to lsof, +f was selected as the analogue to the fuser -c option. (Sorry for the potential confusion.)

### 3.21.2 Why doesn't lsof find all the open files in a file system?

Lsof may not find all the open files in a file system for several reasons.

First, some processes with files open on the file system may have been changing status when lsof examined the process table, and lsof "missed" them. Remember, the kernel changes much faster than lsof can respond to the changes.

Second, be sure you have specified the file system correctly. Perhaps you specified a file instead. You can use lsof's -V option to have lsof report in detail on what it couldn't find. Make sure the report for the file system you specified says "file system." Here's some -V output:

```
$ /lsof -V /tmp ./lsof.h ./lsof
COMMAND PID USER FD TYPE DEVICE SIZE/OFF INODE NAME
lsof 2688 abe txt VREG 18,1,7 1428583 226641 ./lsof
lsof 2689 abe txt VREG 18,1,7 1428583 226641 ./lsof
lsof: no file use located: ./lsof.h
```

You can also use lsof's +f option to force it to consider a path name as a file system. If lsof can't find a file system by the specified name, it will issue a complaint -- e.g.,

```
$ lsof +f -- /usr
lsof: not a file system: /usr
```

(/usr is a directory in the / file system.)

### 3.21.3 Why does the lsof exit code report it didn't find open files when some

files were listed?

Sometimes lsof will list some open files, yet return a non-zero exit code, suggesting it hasn't found all the specified files.

The first thing you should do when you suspect lsof is incorrect is to repeat the request, adding the -V option. In the resulting report you may find that your file system specification really wasn't a file system specification, just a file specification.

Finally, if you specify two files or two file systems twice, lsof will credit all matches to the first of the two and believe that there were no matches for the second. It's possible to specify a single file system twice with different path names by using both its mounted directory path name and mounted-device name.

```
$ lsof +f -V spcuna:/sysprog /sysprog
COMMAND PID USER FD TYPE DEVICE SIZE/OFF INODE NAME
ksh 11092 abe cwd VDIR 39,0,1 1536 226562 /sysprog
(spcuna:/sysprog)
...
lsof: no file system use located: spcuna:/sysprog
```

All matches were credited to /sysprog; none to spcuna:/sysprog.

#### 3.21.4 Why won't lsof find all the open files in a directory?

When you give lsof a simple directory path name argument (not a file system mounted-on name), you are asking it to search for processes that have the directory open as a file, or as a process-specific directory -- e.g., root or current working directory.

If you want to list instances of open files inside the directory, you need to specify the individual path names of those files, or use the lsof +D and +d options.

See the answer to the question "Why are the +D and +d options so slow?" before you use +D or +d casually.

See the answer to the question "Why do the +D and +d options produce warning messages?" for an explanation of some process authority limitations of +D and +d.

### 3.21.5 Why are the +D and +d options so slow?

The +D and +d options cause lsof to build a path name search list for a specified directory. +D causes lsof to descend the directory to its furthest subdirectory, while +d restricts it to the top level. In both cases, the specified directory itself is included in the search list. In both symbolic links are ignored.

Building such a search list can take considerable time, especially when the specified directory contains many files and subdirectories -- lsof must call the system readlink() and stat() functions for each file and directory. Storing the search list can cause lsof to use more than its normal amount of dynamic memory -- each file recorded in the search list consumes dynamic memory for its path name, characteristics, and search linkages. Using the list means lsof must search it for every open file in the system.

Building the search list for a directory specified on some file systems can be slow -- e.g., for an NFS directory with many files. Some file systems have special logging features that can introduce additional delays to the building of the search list -- e.g., NFS logging, or logging on a Solaris UFS file system. The bottom line is that slow search list construction may not be so much an lsof problem as a file system problem. (Hint: if you're using Solaris UFS logging, consider specifying the "logging,noatime" option pair to reduce the number of atime writes to the UFS logging queue and disk.)

A somewhat risky way to speed up lsof's building of the search list is to use lsof's "-O" option. It forces lsof to do all system calls needed to build the search list directly, rather than in a child process. While direct system calls are much faster, they can block in the kernel -- e.g., when an NFS server stops responding -- stopping lsof until the kernel operation unblocks.

As an example of the load +D can impose, consider that an lsof +D / on a lightly loaded NeXT '040 cube with a 1GB root file system disk took 4+ minutes of real time. It also generated several hundred error messages about files and directories the lsof process didn't have permission to access with stat(2).



The bottom line is that +D and +d should be used cautiously. +D is more costly than +d for deeply nested directory trees, because of the full directory descent it causes. So use +d where possible. And you might need to consider the performance of the file system that holds the directory you name with +d or +D.

In view of these warnings, when is it appropriate to use +D or +d? Probably the most appropriate time is when you would specify the directory's contents to lsof with a shell globbing construct -- e.g., `lsof \*`. If that's what you need to do, `lsof +d .` is probably more efficient than having the shell produce a directory list, form it into an argument vector, and pass the vector to lsof for it to unravel.

See the answer to the question "Why do the +D and +d options produce warning messages?" for an explanation of some process authority limitations of +D and +d.

### 3.21.6 Why do the +D and +d options produce warning messages?

+D and +d option processing is limited by the authority of the lsof process -- i.e., lsof can only examine (with lstat(2) and stat(2)) files the owner of the process can access.

If the ownership, group membership, or permissions of the specified directory, file within it, or directory within it prevents the owner of the lsof process from using lstat(2) or stat(2) on it, lsof will issue a warning message, naming the path and giving the system's (lstat(2)'s or stat(2)'s) reason (errno explanation text) for refusing access.

As an example, assume user abc has a subdirectory in /tmp, owned by abc and readable, writable and searchable by only its owner. If user def asks lsof to search for all /tmp references with +D or +d, lsof will be unable to lstat(2) or stat(2) anything in abc's private subdirectory, and will issue an appropriate warning.

Lsof warnings can usually be suppressed with the -w option. However, using -w with +D or +d means that there will be no indication why lsof couldn't find an open reference to a restricted directory or something contained in it.

Hint: if you need to use +D or +d and avoid authority warnings, and if you have super-user power, su and use lsof with +D or +d as root.

### 3.22 Why can't my C compiler find the rpcnt structure definition?

When you try to compile lsof your compiler may complain that the rpcnt structure is undefined. The complaints may look like this:

```
>print.c: In function `fill_portmap':
>print.c:213: dereferencing pointer to incomplete type
>...
```

The most likely cause is that someone has allowed a BIND installation to update /usr/include/netdb.h (or perhaps /usr/include/rpc/netdb.h), removing the rpcnt structure definition that lsof expects to find there.

Only Solaris has an automatic work-around. (See dlsf.h in dialects/sun.). The Solaris work-around succeeds because there is another header file, <rpc/rpcnt.h>, with the rpcnt structure definition, and there is a Solaris C pre-processor test that can tell when the BIND <netdb.h> is in place and hence <rpc/rpcnt.h> must be included.

Doubtlessly there are similar work-arounds possible in other UNIX dialects whose header files have been "touched" by BIND, but in general I recommend restoration of the vendor's <netdb.h> and any other header files BIND might have replaced. (I think BIND replaces <resolv.h>, <sys/bitypes.h>, <sys/cdefs.h> -- and maybe others.)

### 3.23 Why doesn't lsof report fully on file "foo" on UNIX dialect "bar?"

Lsof sometimes won't report much information on a given file, or may even report an error message in its NAME column. That's usually because the file is of a special type -- e.g., in a file system specific to the UNIX dialect -- and I haven't used a system where the file appeared during my testing.

If you encounter such a situation, send me e-mail at <abe@purdue.edu> and we may be able to devise an addition to lsof that

will report on the file in question. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.24 Why do I get a complaint when I execute lsof that some library file can't be found?

On systems where the LIBPATH (or the equivalent) environment variable is used to record the library search path in executable files when they are built, an incorrect value may make it impossible for the system to find the shared libraries needed to load lsof for execution.

This may be particularly true on systems like AIX >= 4.1.4, where the lsof Makefile takes the precautionary step of using the -bnolibpath loader flag to insure that the path to the private static lsof library is not recorded in the lsof binary. Should LIBPATH be invalid when lsof is built, it will be recorded in the lsof binary as the default library path search order and lead to an inability to find libraries when lsof is executed.

So, if you get missing library complaints when you try to execute lsof, check LIBPATH, or whatever environment variable is used on your system to define library search order in executable files. Use the tools at your disposal to look at the library paths recorded in the lsof binary -- e.g., chatr on HP-UX, dump on AIX, ldd on Solaris.

Make sure, too, that when the correct library search path has been recorded in the executable file, the required library files exist at one or more of the search paths.

### 3.25 Why does lsof complain it can't open files?

When lsof begins execution, unless it has been asked to report only help or version information, typically it will attempt to access kernel memory and symbol files -- e.g., /unix, /dev/kmem. Even though lsof needs only permission to open these files for reading, read access to them might be restricted by ownerships and permission modes.

So the first step

to diagnosing lsof problems with opening files is to use ls(1) to examine the ownerships and permission modes of the files that lsof wants to open. You may find that lsof needs to be installed with some type of special ownership or permission modes to enable it to open the necessary files for reading. See the "Installing Lsof" section of 00README for more information.

### 3.26 Why does lsof warn "compiled for x ... y; this is z."?

Unless warnings are suppressed (with -w) or the kernel identity check symbol (HASKERNIDCK) definition has been deleted, all but one lsof dialect version (exception: /proc-based Linux lsof) compare the identity of the running kernel to that of the one for which lsof was constructed. If the identities don't match, lsof issues a warning like this:

```
lsof: WARNING: compiled for Solaris release 5.7; this is 5.6.
```

Two kernel identity differences can generate this warning -- the version number and the release number.

Build and running identity differences are usually significant, because they usually indicate kernels whose structures are different -- kernel structures commonly change at dialect version releases. Since lsof reads data from the kernel in the form of structures, it is sensitive to changes in them. The general rule is that an lsof compiled for one UNIX dialect version will not work correctly when run on a different version.

There are three work-arounds: 1) use -w to suppress the warning -- and risk missing other warnings; 2) permanently disable the identity check by deleting the definition of HASKERNIDCK in the dialect's machine.h header file -- with the same risk; or 3) rebuild lsof on the system where it is to be run. (Deleting HASKERNIDCK can be done with the Customize script or by editing machine.h.)

Generally checking kernel identity is a quick operation for lsof. However, it is potentially slow under AIX, where lsof must run /usr/bin/oslevel. To speed up lsof, use -w to suppress the /usr/bin/oslevel test. See "Why does AIX lsof start so slowly?" for more information.

### 3.27 How can I disable the kernel identity check?

The kernel identity check is controlled by the `HASKERNIDCK` definition. When it is defined, most dialects (exclusion: /proc-based Linux lsof) will compare the build-time kernel identity with the run-time one.

To disable the kernel identity check, disable the `HASKERNIDCK` definition in the dialect's `machine.h` header file. The `Customize` script can be used to do that in its section about the kernel identity check.

Caution: while disabling the kernel identity check may result in smaller lsof startup overhead, it comes with the risk of executing an lsof that may produce warning messages, error messages, incorrect output, or no output at all.

### 3.28 Why don't ps(1) and lsof agree on the owner of a process?

Generally the user ID lsof reports in its `USER` column is the process effective user ID, as found in the process structure. Sometimes that may not agree with what ps(1) reports for the same process.

There are sundry reasons for the difference. Sometimes ps(1) uses a different source for process information, e.g., the /proc file system or the `psinfo` structure. Sometimes the kernel is lax or confused (e.g., Solaris 2.5.1) about what ID to report as the effective user ID. Sometimes the system carries only one user ID in its process structure (some BSD derivatives), leaving lsof no choice.

The differences between lsof and ps(1) user identifications should be small and normally it will be apparent that the confusion is over a process whose application has changed to an effective user ID different from the real one.

### 3.29 Why doesn't lsof find an open socket file whose connection state is past `CLOSE_WAIT`?

TCP/IP connections in states past `CLOSE_WAIT` -- e.g., `FIN_WAIT_1`, `CLOSING`, `LAST_ACK`, `FIN_WAIT_2`, and `TIME_WAIT` -- don't always have open files associated with them. When they don't, lsof can't identify them. When the connection state advances from `CLOSE_WAIT`, sometimes the open file associated with the connection is deleted.

### 3.30 Why don't machine.h definitions work when the surrounding comments are removed?

The machine.h header files in dialect subdirectories have some commented-out definitions like:

```
/* #define HASSYSDC "/your/choice/of/path */
```

You can't simply remove the comments and expect the definition to work. That's intended to make you think about what value you are assigning to the symbol. The assigned value might have a system-specific convention. HASSYSDC, for example, might be /var/db/lsof.dc for FreeBSD, but it might be /var/adm/lsof.dc for Solaris.

Symbols defined in the lsof documentation are described in `00PORTING`, other machine.h comments, and other lsof documentation files. HASSYSDC, for example, is discussed in `00DCACHE`. When comments and documentation don't suffice, consult the source code for hints on how the symbol is used.

### 3.31 What

do "can't read inpcb at 0x...", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE", etc. mean?

Sometimes lsof will report "can't read inpcb at 0x00000000", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE" or a similar message in the NAME column for open TCP socket files. These messages mean the file's socket structure lacks a pointer to the INternet Protocol Control Block (inpcb) where lsof expects to find connection addresses -- local and foreign ports, local and foreign IP addresses. The socket file has probably been submitted to the shutdown(2) function for processing.

In some implementations lsof issues the "no PCB, CANTSENDMORE, CANTRCVMORE" message, which tries to explain the absence of a protocol control block by showing the socket state settings that have been made by the shutdown(2) function.

If a non-zero address follows the "0x" in the "can't read inpcb" message, it means lsof couldn't read inpcb contents from the indicated address in kernel memory.

### 3.32 What do the "unknown file system type" warnings mean?

Lsof may report a message similar to"

```
unknown file system type, v_op: 0x10472f10
```

in the NAME column for some files.

This means that lsof has encountered a vnode for the file whose operation switch address (from v\_op) references a file system type for which there is no support in lsof.

After lsof identifies the file system type, it uses pre-compiled code to locate the file system specific node for the file where lsof finds information like file size, device number, node number, etc.

To get some idea of what the file system type might be, use nm on your kernel symbol file to locate the symbol name that corresponds to the v\_op address -- e.g., on Solaris do:

```
$ nm -x /dev/ksyms | grep 0x10472f10
0x10472f10 ... |file_system_name_vnodeops
```

Where "file\_system\_name" is the clue to the unsupported file system.

Lsof doesn't use the v\_op address to identify file system types on all dialects. Sometimes it uses an index number it finds in the vnode. It will translate that symbol to a short name in the warning message -- e.g., "nfs3" -- if possible.

### 3.33 Installation

#### 3.33.1 How do I install lsof?

There is no "standard" way to install lsof. Too much depends on local conditions for me to be able to provide working install rules in the lsof make files. (The skeleton install rules you will find just give "hints.") See the "Installing Lsof" section of 00README for a fuller explanation.

To install lsof you will need to consider these questions:

- \* Who should be able to use lsof? (See HASSECURITY and HASNOSOCKSECURITY in the "Security" section of 00README.)

- \* Where should lsof be installed? This is a decision mostly dictated by local conditions. Somewhere in /usr/local -- etc/ or sbin/ -- is a common choice.
- \* What permissions should I give the lsof executable? The answer to this varies by dialect. The make files have install rules that give hints. The "Installing Lsof" section of 00README gives information, too.
- \* What if I want to install lsof in a shared file system for machines that require different lsof configurations? See the next question and answer, "How do I install a common lsof when I have machines that need differently constructed lsof binaries?"

### 3.33.2 How do I install a common lsof when I have machines that need differently constructed lsof binaries?

A dilemma that faces some system administrators when they install lsof in a shared file system -- e.g., NFS -- is that they must have different lsof executables for different systems.

The answer is to build an lsof wrapper script that is executed in place of lsof. The script can use system commands to determine which lsof binary should be executed.

Consider this example. You have HP-UX machines with 32 and 64 bit kernels that share the /usr/local/sbin directory where you want to install lsof. Consequently, on each system you must use a different lsof executable, built for the system's bit size. (That's because lsof reads kernel structures, sized by the kernel's bit size.)

One answer is to install three things in /usr/local/sbin: 1) a 32 bit lsof as lsof32; 2) a 64 bit lsof as lsof64; and 3) an lsof script. The script might look like this one, based on work by Amir J. Katz:

```
#!/bin/sh
x=`/usr/bin/getconf KERNEL_BITS` # returns 32 or 64
if /usr/bin/test "X$x" = "X32"
then
 lsof32 $*
else
 if /usr/bin/test "X$x" = "X64"
```



```

 then
Isof64 $*
 else
echo "Can't determine which Isof executable to use;"
echo "getconf KERNEL_BITS says: $x"
exit 1
 fi
fi

```

Solaris users should consult "How do I install Isof for Solaris 7, 8 or 9?" for information on a similar trick using the Solaris isaexec command.

Users of other dialects might be able to use a command like `uname(1)` that can identify a distinguishing feature of the system to be incorporated in pre-installed Isof executable names. For example, use ``uname -r`` and install binaries with suffixes that match ``uname -r`` output.

### 3.34 Why do Isof 4.53 and above reject device cache files built by earlier Isof revisions?

When Isof revisions 4.53 run and encounter a device cache file built by an earlier revision, it will reject the file and build a new one. The rejection will be advertised with these messages:

```

Isof: WARNING: no /dev device in <name>: 2 sections
...
Isof: WARNING: created device cache file: <name>

```

This happens because the header line of the device cache file was changed at revision 4.53 to contain the number of the device on which the device directory resides. The old device cache file header line -- the "2 sections" line in the above warning message, now reads "2 sections, dev=600".

This is not a serious problem, since Isof automatically rebuilds the device cache file with the correct header line.

### 3.35 What do "like block special" and "like character special" mean in the NAME column?

When Isof comes across an open block or character file whose device, raw device and inode place it somewhere other

than /dev (or /devices), lsof doesn't report the /dev (or /devices) name in the NAME column. Instead lsof reports the file system name and device or path name in the NAME column and parenthetically adds "like block special <path>" or "like character special <path>".

The value for <path> will point to a block or character device in /dev (or /devices) whose raw device number matches that of the open file being reported, but whose device number or node number (or both) don't match.

Such an open file is connected to a device node that has been created in a directory other than /dev (or /devices.) See `mknod(8)` for information on how such nodes are created. (Generally one needs root power to create device nodes with `mknod`.)

### 3.36 Why does an lsof make fail because of undefined symbols?

When lsof is compiled via the `make` step and the final load step fails because of missing symbols, the problem may not be lsof. The problem may be that ld, called by the compiler as part of the `make` step, can't find some library that lsof needs.

First check the last compiler line of the make operation -- e.g., the last line with `cc` or `gcc` in it before the undefined symbol report -- for loader arguments, i.e., ones beginning with `-l`. Except for `-llsof` the rest name system libraries. (`-L./lib` precedes `-llsof` to tell the loader its location.)

Check that all the named system libraries exist. Look in `/lib` and `/usr/lib` as a start, but that may not be the only place system libraries live. Consult your dialect's documentation, e.g., the compiler and loader man pages, for other possible locations.

If some system library doesn't exist, that may mean it was never installed or was removed. You'll have to re-install the missing library.

You may find that all the system libraries lsof uses exist. Your next step might be to use `nm` and `grep` to see if any of them contain the undefined symbols.

```
$ nm library | grep symbol
```

If the undefined symbol exists in some library named by the lsof make step, then you might have a problem with some environment variable that controls the load step. The most common is LD\_LIBRARY\_PATH. It may have a setting that causes ld to ignore a directory containing a library lsof names. If this is the case, try unsetting LD\_LIBRARY\_PATH in the environment of the ld process -- e.g., do:

```
$ unset LD_LIBRARY_PATH
```

or

```
% unsetenv LD_LIBRARY_PATH
```

Consult your ld man page for other environment variables that might affect library searching -- e.g., LIBPATH, LPATH, SHLIB\_PATH, etc.

If the undefined function doesn't exist in any libraries lsof names, check other libraries. See if the function has a man page that names its library. If the latter is true, please let me know, because that is an lsof problem I need to fix.

If none of these solutions work for you, send me some documentation via e-mail at <abe@purdue.edu>. Include `uname -a` output, the output of the lsof `Configure ...` and `make` steps, and the contents of the environment in force when the `make` step was executed -- e.g., `env` or `printenv` output. If you've located the libraries lsof names, send me that information, too. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.37 Command Regular Expressions (REs)

#### 3.37.1 What are basic and extended regular expressions?

Lsof's ``-c" option allows the specification of regular expressions (REs), enclosed in two slash (/) characters and followed by these modifiers:

b the RE is a basic RE.

i ignore case.

x the RE is an extended RE (the default).

Note: the characters of the regular expression may need to be quoted to prevent their expansion

by the shell.

Example: this RE is an extended RE that matches exactly four characters, whose third may be an upper ('O') or lower case ('o') oh:

```
-c /^..o.$/i
```

For simplicity's sake, an RE that is acceptable to `egrep(1)` is usually called an extended RE.

REs suitable for the old line editor, `ed(1)`, are often called basic REs (and sometimes also called obsolete).

These are some ways basic REs usually differ from extended REs. (There are other differences.)

\* `\`, `+`, `?`, `{`, and `}` are ordinary characters.

\* `^` is an ordinary character except at the beginning of the RE.

\* `$` is an ordinary character except at the end of the RE.

\* `*` is an ordinary character if it appears at the beginning of the RE.

For more information on REs and the distinction between basic and extended REs, consult your dialect's man pages for `ed(1)`, `egrep(1)`, `sed(1)`, and possibly `regex(5)` or `regex(7)`.

### 3.37.2 Why can't I put a slash in a command regular expression?

Since a UNIX command name is the last part of a path to the command's executable, the `ls(1)` command regular expression (RE) syntax uses slash (/) to mark the beginning and end of an RE. Slash may not appear in the RE and the `\` back-slash escape is ineffective for "hiding" it.

More likely than not, if you try to put a slash in an `ls(1)` command RE, you'll get this response:

```
$ ls(1) -s/.\/ / ...
ls(1): invalid regexp modifier: /
```

Lsof is complaining the the first character it found after the second slash isn't an lsof command RE modifier -- 'b', 'i', or 'x'.

### 3.37.3 Why does lsof say my command regular expression wasn't found?

When you use both forms of lsof's -c option -- ``-c <command>" and ``-c /RE/[m]" -- and ask that lsof do a verbose search (``-V"), you may be surprised that lsof will say that the regular expression wasn't found.

This can happen if the ``-c <command>" form matches first, because then the ``-c/RE/[m]" test will never have been applied.

For example:

```
$./lsof -clsof -c/^..o.$/ -V -adcwd
COMMAND PID USER FD TYPE DEVICE SIZE/OFF NODE NAME
lsof 7850 abe cwd VDIR 6,0 2048 96442 / (/dev/sd0a)
lsof: no command found for regex: ^..o.$
```

The ``-clsof" option matched first, so the ``-c/^..o.\$/ option wasn't tested.

### 3.38 Why doesn't lsof report on shared memory segments?

Lsof reports on shared memory segments only if they're associated with an open file. That's consistent with lsof's mission -- to LiSt Open Files. Shared memory segments with no file associations aren't open files.

That's not to say that a report on shared memory segments and their associated processes wouldn't be useful. But it calls for a new tool, not more baggage for lsof.

### 3.39 Why does lsof report two instances of itself?

When you ask lsof to report all open files and it has permission to do so, you may see two lsof processes in the output. The processes are connected via pipes -- e.g., here's an HP-UX 11 example.

```
COMMAND PID USER FD TYPE DEVICE ...
...
lsof 29450 abe 7w PIPE 0x48732408 ...
lsof 29450 abe 8r PIPE 0x48970808 ...
...
```

```
lsof 29451 abe 6r PIPE 0x48732408 ...
lsof 29451 abe 9w PIPE 0x48970808 ...
```

The first process will usually be the lsof you initiated; the second, an lsof child process that is used to isolate its parent process from kernel functions that can block -- e.g., readlink() or stat().

Information to and from the kernel functions is exchanged via the two pipes. When the parent process detects that the child process has become blocked, it attempts to kill the child. Depending on the UNIX dialect that may succeed or fail, but the parent won't be blocked in any event.

See the "BLOCKS AND TIMEOUTS" and "AVOIDING KERNEL BLOCKS" sections of the lsof man page for more information on why the child process is used and how you can specify lsof options to avoid it. (Caution: that may be risky.)

### 3.40 Why does lsof report '\n' in device cache file error messages?

Lsof revisions prior to 4.58 may report '\n' in error messages it delivers about problems in the device cache file -- e.g.,

```
lsof: WARNING: no ...: 4 sections\n
```

That's deliberately done to show the exact contents of the device cache file line about which lsof is complaining, including its terminating NL (New Line) '\n' character. In the above example the line in the device cache file causing the lsof complaint contains "4 sections" and ends with a '\n'.

At revision 4.58 and above, device cache error messages like the one in the above example have been changed to read:

```
lsof: WARNING: no ...: line "4 sections"
```

The terminal '\n' is no longer reported, the line contents are enclosed in double quote marks (""), and the word "line" has been added as a prefix to denote that what follows is a line from the device cache file.

### 3.41 Kernel Symbol and

## Address Problems

3.41.1 What does "lsof: WARNING: name cache hash size length error: 0" mean?

When run on some systems, lsof may issue this warning:

```
lsof: WARNING: name cache hash size length error: 0
```

That is an example from a FreeBSD system where lsof reads the kernel's `_nchash` variable and finds its value is zero.

Similar warnings include:

```
WARNING: kernel name cache size:
WARNING: can't read kernel's name cache:
WARNING: no name cache address
WARNING: name cache hash size length error:
WARNING: unusable name cache size:
```

These warnings are issued when lsof is attempting to read the kernel's name cache information. They are usually the result of a mis-match between the addresses for kernel symbols lsof gets via `nlist(2)` and the addresses in use by the kernel.

Lsof usually gets kernel symbol addresses from what it believes to be the kernel boot file. In FreeBSD, for example, that's the path returned by `getbootfile(3)`, usually `/kernel`.

The boot file can have other names in other UNIX dialects -- `/unix`, `/vmunix`, `/bsd`, `/netbsd`, `/mach`, `/stand/vmunix`, etc.

Lsof will get incorrect (mismatched) addresses from the boot file if it has been replaced by a newer one which hasn't yet been booted -- e.g., if this is done in FreeBSD:

```
mv /kernel /kernel.OLD
mv /kernel.NEW /kernel
```

Until the FreeBSD system is rebooted, the booted kernel is `/kernel.OLD`, but `getbootfile()` says it is `/kernel`. If symbol addresses important to lsof in `/kernel.OLD` and `/kernel` don't match, the lsof WARNING messages result.

3.41.2 Why does lsof produce "garbage" output?

Kernel name cache warnings may not be the only sign that lsof is using incorrect symbol addresses to read kernel values. If there's no reasonable test lsof can make on what it reads from the kernel, it may issue other warnings or even report nonsensical results.

The warnings may appear on STDERR, such as:

```
lsof: can't read proc table info
```

Or the warnings may appear in the NAME column as messages saying lsof can't read or interpret some kernel structure -- e.g.,

```
... NAME
... can't read file struct from 0x12345
```

One possible work-around is to point lsof's kernel symbol address gathering at the proper boot file. That can be done with lsof's -k option -- e.g.,

```
$ lsof -k /kernel.OLD
```

The best work-around is to make sure the standard boot file is properly sited -- e.g., if you've moved a new /kernel in place, boot it.

### 3.42 Why does lsof report open files when run as super user that it doesn't report when run with lesser privileges?

The most likely cause is that the HASSECURITY option was selected when the lsof executable was built.

If HASSECURITY is defined when lsof is built, and lsof is run with the privileges of a non-ROOT user, it will only list open files belonging to the user. The same lsof executable, when run with root user privileges, will list all open files.

However, if HASSECURITY and HASNOSOCKSECURITY are both defined when lsof is built, lsof will list open files belonging to the user and will also list anyone else's open socket files, provided their listing is selected with the "-i" option.

So first ask yourself if the process whose open files lsof



won't list belong to a user other than the one under which you're running lsof, and are not open socket files. If either is true, use lsof's help (-h or -?) option and look for a line near the bottom of the help panel that says:

```
"... can list all files..."
```

If the leading "..." says "Only root" then HASSECURITY was defined when lsof was built. If the trailing "..." says ", but anyone can list socket files" then HASNOSOCKSECURITY was also defined.

Should you want an lsof not built with HASSECURITY defined, rerun the lsof Configure script. If you let Configure do customization, make sure you answer 'n' when it asks if you want to enable HASSECURITY and HASNOSOCKSECURITY. If you don't need to do customization, you can rebuild lsof with the "-n" option to Configure. Here's an example of such a rebuild sequence:

```
$ Configure -clean
$ Configure -n <dialect-abbreviation>
$ make
```

More information on the HASSECURITY and HASNOSOCKSECURITY options may be found in the "Security" section of the README file of the lsof distribution.

### 3.43 Test Suite Problems

#### 3.43.1 Errors all tests can report:

##### 3.43.1.1 Why do tests complain "ERROR!!! can't execute ../lsof"?

All tests in the test suite expect an executable lsof file to exist in the tests parent directory, ../lsof.

If there's none there, the tests/Makefile has a rule to make it, but there are probably circumstances where that rule may fail.

The work-around is to re-Configure and re-make lsof, then run the test suite.

##### 3.43.1.2 Why do tests complain "ERROR!!! can't find ..." a file?

Many tests create (or use from a supplied environment

variable path) a test file and use lsof to find it. When lsof can't find the file, the tests report the error with messages of the form:

```
ERROR!!! can't find ... : <some file path>
or
ERROR!!! lsof couldn't find ...
```

These type of error messages mean that the lsof field output delivered to the test didn't contain a file that the test could identify as the one it intended lsof to find. It might also mean that the process information -- command name, PID or parent PID -- didn't match what the test expected.

This could imply a bug in the test or a bug in lsof. Try using lsof to find a known file that is open. For example, while in the tests sub-directory, do this:

```
$ sleep 30 < Makefile
$../lsof Makefile
```

If lsof doesn't report that Makefile is open, then the fault may be with lsof. If lsof reports the file is open, search further in the test code for the failure cause.

#### 3.43.1.3 Why do some tests fail to compile?

If a test suite program fails to compile, it may be because I've never had an opportunity to compile the test on the particular UNIX version you are using.

See Appendix B in OOTEST for a list of the UNIX dialects where the test suite has been validated.

#### 3.43.1.4 Why do some tests always fail?

There are several tests in the optional group that have conflicting or special requirements:

LTbigf needs a dialect and file system that support large files.

LTlock won't work if the tests/ sub-directory is on an NFS file system.

LTnfs won't work if the tests/ sub-directory is not on an NFS file system.

So for two tests in particular, LTlock and LTnfs, one will generally fail.

Some failing tests can be run successfully by supplying to them a path to the appropriate type of file system with the -p option.

#### 3.43.1.5 Why does the test suite say it hasn't been validated on my dialect?

When you use the default rule of the test suite's Makefile, it may issue this complaint:

```
$ cd tests
$ make
!!!WARNING!!!
```

This dialect or its particular version may not have been validated with the lsof test suite. Consequently some tests may fail or may not even compile.

```
!!!WARNING!!!
```

You are then given the opportunity to answer 'y' to have the test suite operation continue.

This message means that the tests/TestDB file in the tests sub-directory doesn't show that the test suite has been run with the combination of compiler flags found in tests/config.cflags. The tests might not run; they may encounter compiler failures.

See 00TEST for more information on the UNIX dialects where the test suite has been validated and on the workings of TestDB and its supporting scripts.

When the tests/Makefile "auto" rule is used, the message is more terse and the condition is fatal.

```
This suite has not been validated on:
```

```
<dialect_description>
```

No opportunity to continue is offered.

The tests/Makefile "silent" rule will skip checking for the validation footprint.

### 3.43.1.6

Why do the tests complain they can't stat() or open() /dev/mem or /dev/kmem?

When the tests detect that lsof for the dialect reads its information from kernel memory (i.e., the LT\_KMEM definition is present in tests/config.cflags), and when the lsof executable path is ../lsof, the tests make sure they can stat() and open() for read access the relevant kernel memory devices, /dev/kmem and possibly /dev/mem.

If those stat() or open() operations fail, the tests issue an error message and quit. The message explains why the system rejected the operation in terms of system "errno" symbols and messages. More often than not the explanation will be that the process lacks permission to access the indicated device node.

One work-around is to give the lsof executable being tested the necessary permission -- e.g., via chgrp, chmod, etc. -- and set its path in the LT\_LSOF\_PATH environment variable. (See 00TEST.)

Another work-around is to make sure the process that runs the tests has the necessary permissions -- e.g., run it as root, or enable the process login to access the resources. For example, I can run the tests on my personal work-station because /dev/kmem and /dev/mem are readable by the "kmem" group and my login is in that group.

### 3.43.2 LTbigf test issues

#### 3.43.2.1 Why does the LTbigf test say that the dialect doesn't support large files?

Large file support is defined dialect by dialect in the lsof source files and Configure script. If large file support isn't defined there, it isn't defined in the LTbigf test.

If you think that's wrong for a particular dialect, contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the

"Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.43.2.2 Why does LTbigf complain about operations on its config.LTbigf\* file?

The LTbigf must be able to write a large file test (size > 32 bits) and seek within it and the process file ulimit size must permit the operation. If the default location for the test file, tests/, isn't on a file system enabled for large file operations or if the process ulimit file block size is too small, lsof will get file operation errors, particularly when seeking

There may be a work-around. Specify the path to a file LTbigf can write in a file system enabled for large file operations a the -poption. Make sure that the ulimit file block size permits writing a large file. For example, presuming /scratch23 is large-file-enabled, and presuming you have permission to raise the ulimit file block size, this shell commands will allow the LTbigf test to run on AIX:

```
$./LTbigf -p /scratch23/abe/bigfile
```

(Note: syntax for the ulimit command varies by dialect and by shell. Discovering the proper variant is left to the reader.)

More information on this subject can be found in the LTbigf description in the 00TEST file. Of course, the LTbigf.c source file in tests/ is the ultimate source of information,

### 3.43.2.3

Why does LTbigf warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTbigf knows that lsof can't report file offsets for the dialect, it issues this warning:

```
LTbigf ... WARNING!!! lsof can't return file offsets
for this dialect, so offset tests have
been disabled.
```

LTbigf then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

### 3.43.3 Why does the LTbasic test complain "ERROR!!! lsof this ..." and "ERROR!!! lsof that ..."?

The LTbasic test program uses lsof to examine a running lsof process. It looks for the lsof current working directory, executable (if possible), and kernel memory file (if applicable).

Failures to find those things result in the LTbasic error messages. More information on how LTbasic produces the error messages may be found in the LTbasic.c source file.

On HP-UX 11.11 and higher, for example, if the test's current working directory is on a loopback (LOFS) file system, LTbasic won't be able to find the current working directory of the lsof process because of a bug in the HP-UX kernel.

The solution for that HP-UX problem is to install an HP-UX patch. See the answer to the "Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?" question for more information on the patch.

### 3.43.4 NFS test issues

#### 3.43.4.1 Why does the LTnfs test complain "couldn't find NFS file ..."?

The LTnfs test must work with an NFS test file. After it opens the file it asks lsof to find it on an NFS file system. If the file isn't on an NFS file system, lsof won't find it, and the NFS test script complains and fails.

The work-around is to use -p option to supply a path to a regular NFS file (not a directory) that is on an NFS file system that LTnfs can read. Presuming /share/bin/file is such a file and can be opened for reading by the LTnfs test, this sample shell command could be used to run the LTnfs test successfully:

```
$./LTnfs -p /share/bin/file
```

(If the NFS file system is enabled for large files, the

NFS test will produce the error message described in the following Q&A.)

### 3.43.5 LTnlink test issues

#### 3.43.5.1 Why does the LTnlink test complain that its test file is on an NFS file system?

The LTnlink test may complain:

```
LTnlink ... WARNING!!! test file <path> is NFS mounted.
```

and then issue an explanation and a hint about using the -p option.

The LTnlink test does this because of the way NFS file links are managed when an NFS file is unlinked and the unlinking process still has the file open. Unlike with files on a local file system, when an NFS file that is still open is unlinked, its link count is not reduced.

The file name is changed to a name of the form .nfsxxxx and the link count is left unchanged until the process holding the file open closes it. That's done by NFS so it can keep proper track of the file on NFS clients and servers.

Since the link count isn't reduced when the LTnlink test program closes the NFS test file it still has open, lsof won't find it for LTnlink with a link count of zero. Consequently, LTnlink disables that test section and issues its warning.

The warning suggests that the unlink test section can be run by giving LTnlink a path to a test file with the -p option. That path must name a file LTnlink can write and unlink. Presuming /scratch23/abe/nlinkfile is on a local file system and the LTnlink test can write to it and unlink it, this sample shell command can be used to run the complete LTnlink test successfully:

```
$ LTnlink -p /scratch23/abe/nlinkfile
```

#### 3.43.5.2 Why does LTnlink delay and report "waiting for link count update: ..."?

On some UNIX dialects and file system combinations the updating

of link count after a file has been unlinked can be delayed. Consequently, lsof won't be able to report the updated link count to LTnlink for a while.

When lsof doesn't report the proper link count to LTnlink, it sleeps and repeats the lsof call, using the "waiting for link count update: ..." message as a signal that it is waiting for the expected lsof response. The wait cycle duration is limited to approximately one minute.

### 3.43.5.3 Why does LTnlink fail because of an unlink error?

LTnlink may fail with an error similar to:

```
LTnlink ... ERROR!! unlink(<name>) failed: (Permission denied).
```

That message will be followed by a short explanation.

The error means that the kernel support for the file system on which the file <name> resides does not allow a process to unlink a file while it has the file open. (When LTnlink is run without the "-p path" option, it creates a <name> that begins with "./config.LTnlink" and ends with the LTnlink process ID number.)

An unlink failure of this type runs counter to original UNIX file system behavior, but it has been observed on some file system types, especially on the ZFS file system.

The work-around is to run LTnlink on a file system that allows a process to unlink a file it has open. Usually /tmp has that support. So, try running LTnlink this way:

```
$./LTnlink -p /tmp/<name>
```

where <name> is a unique name in /tmp of your choosing. To be safe, create a subdirectory in /tmp, named by your login:

```
$ rm -f /tmp/<login>
$ mkdir /tmp/<login>
$./LTnlink -p /tmp/<login>/<name>
```

### 3.43.6 LTdnlc test issues

#### 3.43.6.1 Why won't the LTdnlc test run?

lsof is unable to access the DNLC cache on AIX, because the



kernel symbols for the DNLC aren't exported. Contact IBM to learn why that decision was made.

The LTdnlc test won't work on Apple Darwin because lsof can't obtain reliable DNLC information.

The LTdnlc test may fail on other dialects. Failure causes include: a busy system with a DNLC that is changing rapidly; path name components too large for the DNLC; a file system -- e.g., NFS, /tmp, loopback -- which doesn't fully participate in the DNLC; or DNLC limitations (Many DNLC implementations will only store path name components if they are 31 characters or less.)

If you suspect the file system doesn't fully participate in kernel DNLC processing, as a work-around rebuild and test lsof on one that does.

#### 3.43.6.2 What does the LTdnlc test mean by "... <path> found: 100.00%"?

Even when it succeeds the LTdnlc test will report:

```
LTdnlc ... /export/home/abe/src/lsof4/tests found: 100.00%
```

This message means that the LTdnlc test asked lsof to find the file at the indicated path five times and lsof found the full path name in the indicated percentage of calls. The LTdnlc test considers it a failure if the percentage falls below 50.0%

#### 3.43.6.3 Why does the DNLC test fail?

The DNLC test may fail when some component of the lsof tests/ sub-directory can't be cached by the kernel DNLC. Some kernels have a limit on the length of individual components (typically) 32.

#### 3.43.7 Why hasn't the test suite been qualified for 64 bit HP-UX 11 when lsof is compiled with gcc?

When I attempted to qualify lsof for HP-UX 11, compiled with gcc 3.0, the LTsock test failed. I traced the failure to a gcc compilation error. Because LTsock is an important test, I didn't feel that the test suite was qualified if it failed.

LTsock compiles and runs correctly on 64 bit HP-UX 11 when compiled with HP's ANSI-C.

### 3.43.8 LTzoff test issues

#### 3.43.8.1 Why does LTzoff warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTzoff knows that lsof can't report file offsets for the dialect, it issues this warning:

```
LTzoff ... WARNING!!! lsof can't return file offsets
for this dialect, so offset tests
have
been disabled.
```

LTzoff then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

### 3.43.9 LTlock test issues

#### 3.44 File descriptor list (the ``-d" option) problems

##### 3.44.1 Why does lsof reject a ``-d" FD list?

lsof rejects ``-d" FD lists that contain both exclusions and inclusions with messages like:

```
lsof: exclude in an include list: ^1
lsof: include in an exclude list: 2
```

That's because ``-d" FD lists are processed as ORed lists, so it makes no sense for them to contain both exclusions and inclusions.

I.e., if a ``-d" FD list were to contain ``^cwd,1", the ``^cwd" member is useless, because the ``1" member dominates by saying "include only FD 1". That effectively excludes ``cwd" FD.

Note that lists may have multiple members of the same type, exclude or include. They are processed as an ORed set. If an FD isn't

excluded by any member of an exclude list, it is selected. If an FD is included by any member of an include list, it is selected.

### 3.44.2 Why are file descriptors other than those in my FD list reported?

The FD list that follows `--d` excludes or includes file descriptors, but unless the `--a` (AND) option is specified, the FD list selections are ORed to the other selections.

For example, the following `lsof` command will cause all file descriptors to be listed for the `lsof` command, and all but the `cwd` descriptor for all other commands, probably not what was intended.

```
$ lsof -clsof -d^cwd
```

Hint: use `--a` -- e.g.,

```
$ lsof -clsof -a -d^cwd
```

### 3.45 How can I supply device numbers for inaccessible NFS file systems?

When `lsof` can't get device numbers for inaccessible NFS file systems via `stat(2)` or `lstat(2)`, it attempts to get them from the mount table's `dev=xxx` options. Successes are reported with a warning message that indicates the source of the device number and that output might be incomplete as a consequence of the warnings.

Some system mount tables -- e.g., Linux `/proc/mounts` -- don't have a `dev=xxx` option. In that case, and provided `lsof` for the dialect supports them, you can use the `+m` option to create a mount table supplement file and the `" +m m"` option to use it.

First check the `lsof -h` (help) output to see if the `+m` and `" +m m"` options are supported. If they are, use `+m` to create a mount table supplement file when all mounted file systems are accessible. Use `" +m m"` later to make the supplement available when some mounted file systems might not be available.

Here's an example that creates a mount supplement file in `$HOME/mnt-sup` and later makes it available to `lsof`.

```
$ rm -f $HOME/mnt-sup
```

```
$ lsof +m > $HOME/mnt-sup
```

```
...
```

```
$ lsof +m $HOME/mnt-sup <other lsof options>
```

If lsof has to get the device number from the supplement, it will issue an informative warning message. The warning can be suppressed with lsof's -w option.

Caution! Since the mount table supplement file is static, it is its supplier's responsibility to update it as file system mounts change.

For more information, consult the lsof man page. The "ALTERNATE DEVICE NUMBERS" section has useful information on how lsof acquires device numbers when stat(2) or lstat(2) fail.

### 3.46 Why won't lsof find open files on over-mounted file systems?

When a file system, /xyz for example, is mounted on the same mount point as another file system, /abc for example, running lsof with an argument of the path of the first file system's mount point -- the over-mounted one, /abc -- probably will not reveal any files open on /abc.

That's because lsof looks for open files on a file system by looking for files with the file system's device number. The two file systems usually have different device numbers and lsof determines the device number search key from the supplied name of the second file system.

A general work-around exists only for Linux. On that UNIX dialect, when you know the over-mounted file system's mount point path, you can ask lsof to report on all open files and grep that output for the path of the over-mounted file system mount point.

### 3.47 What can be done when lsof reports no more space?

Many lsof methods cache information in memory, using the dialects malloc() library function. When malloc() can't allocate the requested amount of memory, lsof exits with warning messages similar to this AIX message:

```
lsof: no more dev-ch space at pid 2257750: 0x82a8e600
```

Lsof then exits immediately and produces no more output.

A possible work-around is to increase the memory foot print of the shell that runs lsof. That is often done with the `ulimit(1)` shell command.

### 3.48 What if the lsof build encounters ar and ld problems?

The lsof main and library Makefiles use the library archiver, ar, and the system loader, ld, applications. Improperly located, installed or configured versions of them may cause the lsof build to encounter errors with them.

The application producing the error should identify itself in its error messages.

The first thing to check the path of the application that is being used. Try ``which ar`` or ``which ld`` to see if perhaps the PATH used during the build might be causing the wrong archiver or loader to be used.

If the problem is with the use of the wrong archiver, and it's not possible to correct the PATH to it, try using the `LSOF_AR` environment variable to specify the path to and arguments for the correct archiver. See `00XCONFIG` for more information and note that `LSOF_AR` must specify the path to the archive application and the arguments for it, less the terminating library and module name arguments.

If the problem is with the loader, there is no lsof work-around. That's because lsof calls the loader via the C compiler, so the problem must be fixed at the compiler (system) level.

## 4.0 AIX Problems

### 4.1 What

is the Stale Segment ID bug and why is `-X` needed?

Kevin Ruderman reports that he has been informed by IBM that processes using the AIX 3.2.x, 4.1[.12345], 4.2[.1], and 4.3.x kernel's `readx()` function can cause other AIX processes to hang because of what appears to be file system corruption.

This failure, known as the Stale Segment ID bug, is caused

by an error in the AIX kernel's journaled segment memory handler that causes the kernel's `dir_search()` function erroneously to believe directory entries contain zeroes. The process using the `readx()` call need not be doing anything wrong. Usually the system must be under such heavy load that the segment ID being used in the `readx()` call has been freed and then reallocated to another process since it was obtained from kernel memory.

Lsof uses the `readx()` function to access library entry structures, based on the segment ID it finds in the `proc` structure of a process. Since IBM probably will never fix the kernel bug, I've added an AIX-specific option to lsof that controls its use of the `readx()` function.

By default lsof `readx()` use is disabled; specifying the `--X` option enables `readx()` use.

If you want to change the default `readx()` behavior of AIX lsof, change the `HASXOPT`, `HASXOPT_ROOT`, and `HASXOPT_VALUE` definitions in `dialects/aix/machine.h`. You can also use these definitions to enable or disable `readx()` -- consult the comments in `machine.h`. You may want to disable `readx()` use permanently if you plan to make lsof publicly executable.

When `HASXOPT_ROOT` is defined, lsof will restrict use of the `-X` option to processes whose real UID is root; if `HASXOPT_ROOT` isn't defined, any user may specify the `-X` option. The `Customize` script offers the option to change `HASXOPT_ROOT` when `HASXOPT` is defined and `HASXOPT_ROOT` is named in any dialect's `machine.h` header file.

I have never seen lsof cause a problem with its use of `readx()`, but I believe there is some chance it could, given the right circumstances.

#### 4.1.1 Stale Segment ID APAR

Here are the details of the Stale Segment ID bug and IBM's response, provided by Kevin Ruderman.

AIX V3

APAR=ix49183

user process hangs forever in kernel due to file system corruption

STAT=closed prs TID=tx2527 ISEV=2 SEV=2

(A "closed prs" is one closed with a Permanent ReStriction.)

RCOMP=575603001 aix v3 for rs/6 RREL=r320

AIX V4 (internal defect, no apar #)

prefix p  
name 175671  
abstract KERMP: loop for ever in dir\_search()

Problem description:

1. Some user application -- e.g., lsof -- gets the segment ID (SID) for the process private segment of a target process from the process table.
2. The target process exits, deleting the process private segment.
3. The SID is reallocated for use as a persistent segment.
4. The user application runs again and tries to read the user area structure from /dev/mem, using the SID it read from the process table.
5. The loads done by the driver for /dev/mem cause faults in the directory; new blocks are allocated; the size changed; and zero pages created.
6. The next application that looks for a file in the affected directory hangs in the kernel's dir\_search() function because of the zero pages. This occurs because the kernel's dir\_search() function loops through the variable length entries one at a time, moving from one to the next by adding the length of the current entry to its address to get the address of the next entry. This process should end when the current pointer passes the end of the known directory length.

However, while the directory length has increased, the entry length data has not, so when dir\_search() reaches the zero pages, it loops forever, adding a length of zero to the current pointer, never passing the end of the directory length. The application process is hung; it can't be killed or stopped.

IBM closed the problem with a PRS code (Permanent ReStriction)

under AIX Version 3 and had targeted a fix for AIX 4.2. They have recently (I became aware of it September 10, 1996) cancelled the defect report altogether and have indicated they are not going to fix the defect.

#### 4.2 Gcc Work-around for AIX 4.1x

When gcc is used to compile lsof for AIX 4.1x, it doesn't align one element of the user structure correctly. Xlc sees the U\_irss element as a type "long long" and aligns it on an 8 byte boundary. That's because the default mode of xlc is -qlonglong; when -qlonglong is enabled, the \_LONG\_LONG symbol is also defined.

Gcc sees U\_irss as a two element array of type long, because \_LONG\_LONG isn't defined. Hence gcc aligns the U\_irss element array on a 4 byte boundary, rather than an 8 byte one, making the gcc incantation of the user structure 4 bytes shorter than xlc's.

When the length of gcc's user structure is supplied as argument 4 to the undocumented getuser() function of the AIX kernel, getuser() rejects it as an incorrect size and returns EINVAL.

Lsof has a work-around for this problem. It involves a special test in the Configure script when the "aixgcc" Configure abbreviation is used -- e.g.,

```
$ Configure -n aixgcc
```

The test is to compile a small program with gcc and check the alignment of U\_irss. If it's not aligned on an 8 byte boundary, the Configure script makes a special copy of <sys/user.h> in ./dialects/aix/aix<AIX\_version> whose U\_irss will align properly, and generates compile time options to use it.

While I have tested this work-around only with 4.1.4, it should work with earlier versions of AIX 4.1. It does not work for AIX 4.2; a different work-around is employed there. (See the next section.)

If you want to use this technique to compile other AIX 4.1x programs with gcc for using getuser(), check the Configure script.



Stuart D. Gathman identified this gcc AIX alignment problem.

#### 4.3 Gcc and AIX 4.2[.1]

Alignment problems with gcc and AIX 4.2[.1] inside the user structure are more severe, because there are some new 64 bit types in AIX that gcc doesn't yet (as of 2.7.x) support. The `<sys/user.h>` `U_irss` element problem, discussed in 4.3 above, doesn't exist in 4.2[.1].

The AIX `lsof` machine.h header file has a work-around, provided by Henry Grebler, that bypasses gcc alignment problems. Later versions of gcc (e.g., 2.8.x) will probably bypass the problems as well.

#### 4.4 Why won't lsof's Configure allow the use of gcc for AIX below 4.1?

Gcc can't reliably be used to compile lsof for AIX versions below AIX 4.1 because of possible kernel structure element alignment differences between it and xlc.

#### 4.5 What is an AIX SMT file type?

When you run AIX X clients with the `DISPLAY` environment variable set to ```:0.0"` they communicate with the AIX X server via files whose kernel file structure has an undefined type (`f_type == 0xf`) -- at least there's no definition for it in `<sys/file.h>`.

These are Shared Memory Transport (SMT) sockets, an artifact of AIXWindows, designed for more efficient data transfers between the X server and its clients.

Henry Grebler and David J. Wilson alerted me to the existence of these files. Mike Feldman and others helped me identify them as SMT sockets.

The curious reader can find more about SMT sockets in `/usr/lpp/X11/README.SMT`.

#### 4.6 Why does AIX lsof start so slowly?

When AIX lsof starts it compares the running kernel's identity to the one for which it was built, using `/usr/bin/oslevel`. That comparison can sometimes take a

long time to complete, depending on the system's maintenance level and how recently it was examined with `oslevel`.

AIX revisions 4.67 and above for AIX 5 and above don't use `oslevel` to determine the kernel identity. They use `uname(2)` instead, and it is much faster.

You can skip the `oslevel` test by suppressing warning messages with `lsof's -w` option. Doing that carries with it the risk of missing other warning messages, however.

You can also disable the kernel identity check by disabling the definition of the `HASKERNIDCK` symbol by editing AIX `machine.h` header file or by using the `Customize` script to disable it.

See the "Why does `lsof` warn "compiled for x ... y; this is z.?" section for more information.

#### 4.7 Why does `exec` complain it can't find `libc.a[shr.o]`?

When you try to execute `lsof` you may get this complaint:

```
exec(): 0509-036 Cannot load program ./lsof because of
the following errors:
0509-022 Cannot load library libc.a[shr.o].
0509-026 System error: A file or directory in
the path name does not exist.
```

This is probably the result of making `lsof` when the `LIBPATH` environment variable contained a directory path that doesn't contain `libc.a`. You can see what `LIBPATH` contained when `lsof` was made by using the `dump` application on `lsof`. For example, if `LIBPATH` contained `/foo/bar` when `lsof` was made, you will see this (partial) dump output:

```
$ dump -H lsof
...
Import File Strings
INDEX PATH BASE ...
0 /foo/bar
```

To correct the problem, revisit the `lsof` source directory and remake `lsof` this way:

```
$ unset LIBPATH; make (sh or ksh)
```

or

```
% unsetenv LIBPATH; make (csh or tcsh)
```

4.8 What does lsof mean when it says, "no PCB, CANTSENDMORE, CANTRCVMORE" in a socket file's NAME column?

When an AIX application calls shutdown(2) on an open socket file, but hasn't called close(2) on the file, the file will remain visible to lsof as an open socket file without any extended protocol information.

Lsof reports that state in the NAME column by saying that there is "no PCB" (Protocol Control Block) for the protocol (e.g., TCP in the NODE column). If the open socket file has the state variables SO\_CANTSENDMORE and SO\_CANTRCVMORE set -- i.e., from the shutdown(2) call -- lsof reports them with the CANTSENDMORE and CANTRCVMORE notes in the NAME column.

4.9 When the -X option is used on AIX 4.3.3, why does lsof disable it, saying "WARNING: user struct mismatch; -X option disabled?"

The -X option causes lsof to read the loader information of the user structure from virtual memory via the readx() system call. It does that with the user structure definition from <sys/user.h> that was compiled into the lsof executable.

On AIX 4.3.3 there are two different user structure definitions in two separate <sys/user.h> header files, distributed at different times by IBM. If lsof was compiled with one and the kernel on which lsof is being run was compiled with the other, lsof normally won't get correct loader information when it calls readx().

In an attempt to compensate for that difference, lsof makes an independent check of the loader information by getting the user structure's open file count via readx() and comparing it to the open file count obtained independently via getprocs().

When the two counts don't match, lsof tries to read the count (and re-read the loader information) with two offsets, based on observed differences between the two user structures.

When one of the three attempts produces a correct open file count, lsof uses its corresponding offset on subsequent readings of the loader information.

When none of the three attempts produces a correct open file count, lsof issues the WARNING message and disables -X processing.

To eliminate this problem, obtain an lsof binary that matches the kernel of the AIX 4.3.3 system where you want to run lsof. Compiling lsof on the target system is the preferred way to get a matching binary.

#### 4.10 Why doesn't the -X option work on my AIX 5L or 5.[123] system?

If your AIX 5L or 5.[123] system uses the ia64 architecture, lsof needs setuid-root permission to be able to do the processing that -X requires.

Check the output of ``uname -a`` to determine the architecture type.

The work-around is to give lsof setuid-root permission.

#### 4.11 Why doesn't /usr/bin/oslevel report the correct AIX version?

The oslevel man page says, "The oslevel command reports the level of the operating system using a subset of all filesets installed on your system."

You can see which fileset is below the expected level with oslevel's -l option. For example, if you believe your system is at AIX level 4.3.3, but oslevel reports 4.3.2, use this oslevel command to find the filesets below 4.3.3:

```
$ /usr/bin/oslevel -l 4.3.3.0
```

If you don't know what level argument to supply to oslevel's -l option, use oslevel's -q option first.

##### 4.11.1 Why doesn't /usr/bin/oslevel report the correct AIX version on AIX 5.1?

The subset list for oslevel on AIX 5.1 seems to include at least two filesets, xlsmp.msg.en\_US.rte and xlsmp.rte, that do not install from AIX 5.1 media with a 5.1.0.0 level. Hence, oslevel reports 5.0.0.0 instead of the expected 5.1.0.0.

If either xlsmp.msg.en\_US.rte or

xlsmp.rte is installed,  
lsof's Configure script and run-time tests will identify  
the AIX version incorrectly. The run-time test will  
issue a complaint message of this form:

```
lsof: WARNING: compiled for AIX version xxx; this is yyy.
```

You can correct the Configure test by pre-defining the  
oslevel value, setting the correct value in the LSOF\_VSTR  
environment variable before running the Configure script  
-- e.g., to pre-define AIX 5.1 when using ksh, do this:

```
$ LSOF_VSTR=5.1.0.0 Configure -n aix
```

You can't affect oslevel output without uninstalling  
xlsmp.msg.en\_US.rte and xlsmp.rte. If you can't do that,  
you'll have to put up with the run-time complaint.

#### 4.12 Why does lsof for AIX 5.1 or above Power architecture complain about kernel bit size?

When you run an lsof binary on an AIX 5.1 or above Power  
system, it might complain:

```
lsof: FATAL: compiled for a 32 bit kernel.
```

```
The bit size of this kernel is 64.
```

or

```
exec: 0509-036 Cannot load program ./lsof
```

because of

```
the following errors:
```

```
0509-032 Cannot run a 64-bit program on a 32-bit
machine.
```

Starting at lsof revision 4.61, lsof binaries for Power  
architecture systems running AIX 5.1 or above are closely  
tied to the kernel bit size. lsof must do that so it can  
read and understand kernel structures.

lsof's Configure script tunes the lsof configuration so  
that the binary built in the make(1) step is adjusted to  
the kernel bit size.

An lsof binary knows the bit size for which it was constructed,  
tests the bit size of the kernel under which it is running,  
and objects if the two sizes don't match. To see the bit  
size for which lsof was constructed, run it with its -v  
option and look for these lines in the output:

configuration info: 32 bit kernel

or

configuration info: 64 bit kernel

(Note: these lines will appear only in -v output for AIX 5.1 and above lsof binaries, built for Power architecture.)

You can see the kernel bit size test method in the aix stanza of the lsof Configure script and in the get\_kernel\_access() function of the lsof .../dialects/aix/dproc.c source file.

There is more information on pre-defining the kernel bit size when building lsof in Configure, 00PORTING, and 00XCONFIG.

The only work-around is to use an lsof binary built to match the running kernel bit size.

4.13 What can't gcc be used to compile lsof on the ia64 architecture for AIX 5 and above?

Gcc can't be used to compile lsof on the ia64 architecture for AIX 5 and above because I haven't had access to a system that has a working gcc compiler. The gcc compiler on my one and only ia64 AIX 5.1 test system, provided by IBM, didn't work at all.

4.14 Why does lsof get a segmentation fault when compiled with gcc for a 64 bit Power architecture AIX 5.1 kernel?

When lsof is configured with the lsof "aixgcc" Configure abbreviation, the resulting lsof executable may cause a segmentation violation when it is run. I've observed this with gcc version 2.9-aix43-010414-7.

As far as I have been able to tell, the segmentation fault is the result of a gcc compilation, loading, or library error. Watching lsof run with gcc's companion debugger, gdb, shows no error in the lsof source code that might explain the fault.

The only work-around I know is to use the IBM C compiler in place of gcc -- i.e., use the "aix" lsof Configure abbreviation.

4.15 Why does lsof ignore AFS on my AIX system?

The lsof Configure script quits on AIX when AFS is present, the AIX version is greater than 4.3.3.0 or the AFS version is greater than 3.5. That's because I have no test systems available for those AIX and AFS version combinations.

When the lsof Configure script detects an AIX and AFS version combination that is unsupported, it will report:

```
!!!FATAL: Lsof does not support AFS on this combination of
AIX and AFS versions. To disable AFS, set the
value of the AIX_HAS_AFS environment variable
to
"no".
```

The only work-around is to set the AIX\_HAS\_AFS environment variable as explained in the error message:

```
$ AIX_HAS_AFS=no; export AIX_HAS_AFS
$./Configure -n aix
```

#### 4.16 Why does lsof report "system paging space is low" and exit?

When AIX paging space runs low, the AIX kernel sends a SIGDANGER signal to processes, warning them that they should reduce their memory usage.

When lsof receives that signal, it issues the following fatal error message and exits:

```
lsof: FATAL: system paging space is low.
```

A possible work-around is to limit the amount of information lsof must cache in its process memory with the "-c", "-g", "-l" and "-p" options.

Also see the answer to the "What can be done when lsof reports no more space?" question.

#### 4.17 Why does lsof have a compilation problem on AIX 5.3 above maintenance level 1?

On some AIX 5.3 systems with maintenance levels 2 and higher installed, lsof 4.77 and below may not compile properly. The compiler complains the snapshotObject structure definition, needed by <j2/j2\_inode.h>, is missing.

That problem is fixed in the 4.78 revision.

## 5.0 Apple Darwin Problems

### 5.1 What do /dev/kmem-based and libproc-based mean?

Lsof for Apple Darwin currently uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.

At an upcoming release lsof will use a library called libproc to obtain information about open files. That version of lsof will be called libproc-based lsof.

The /dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/darwin branch of the lsof source tree. When the supporting version of Apple Darwin is released, the libproc-based lsof sources will be found in .../dialects/darwin/libproc.

### 5.2 /dev/kmem-based Apple Darwin Questions

#### 5.2.1 Why does Configure ask for a path to the Darwin XNU kernel header files?

When lsof was ported to Apple Darwin by Allan Nathanson at revision 4.53, some kernel header files needed by lsof weren't being exported by the developers. (That's still true at lsof revision 4.76.)

At first a shell script that Allan provided would get the missing header files by checking them out from the CVS root. Although the script was updated from time to time, eventually the re-organization of Darwin sources has made it impossible to update the script to do an automatic download of the missing header files.

At lsof revision 4.69 and above it is necessary for the Darwin lsof builder to download the Darwin XNU kernel headers before attempting to build lsof. The download may be done via a web browser, starting at this URL:

<http://www.opensource.apple.com/darwinsource/index.html>

Once there, select the link to the Mac OS X version that



matches the one on the system where lsof is to be built.

Follow that link's "[ Source ]" link. Once there, select the tar.gz link of the xnu\* entry near the bottom of the page.

That entry should have a name that matches the xnu\* name shown by ``uname -a`` -- e.g., if uname reports:

```
$ uname -a
... root:xnu/xnu-517.7.21 ...
```

Then the appropriate xnu\* entry is xnu-517.7.21. Clicking its link should lead to an "Apple Open Source" page requesting an Apple ID and password.

Enter them if they're available. If an Apple ID and password are not available, get them by following the instructions on the page -- i.e., follow the [signin.apple.com](http://signin.apple.com) link.

Once a valid Apple ID and its password have been entered, the download will begin. Select the saving of the downloaded xnu\*.tar.gz file in an appropriate place on the Mac OS X system.

Once the download completes, install it. Use gunzip to decompress the download and tar to extract the archive -- e.g.,

```
$ gunzip -c xnu-517.7.21.tar.gz | tar xf -
```

Remember the absolute path to the extracted archive. That is its installed place. E.g., if the xnu-517.7.21.tar archive was extracted to the lsof builder's home directory, its full installation path will be something like:

```
~/xnu-517.7.21
```

Now run the lsof Configure script. When it asks for the path to the installed Darwin XNU kernel header files, supply the path to the gunzip'd and extracted xnu\* archive -- e.g., `~/xnu-517.7.21`.

The path to the Darwin XNU kernel headers may also be supplied to the Configure script in the `DARWIN_XNUDIR` environment variable, eliminating the need to enter it interactively -- e.g.,

```
$ DARWIN_XNUDIR=~/xnu-344.49 ./Configure -n darwin
```

### 5.2.1.1 Why does Configure complain that Darwin XNU kernel header files are missing?

These are some reasons why the Isof Configure script might claim that Darwin XNU header files are missing:

- \* The wrong path to them was specified.
- \* The files and directories in the path are not readable and searchable -- i.e., check the modes and ownerships.
- \* The downloaded archive doesn't match the Mac OS X version of the system.

If in doubt, revisit the Darwin XNU kernel header file download instructions in the answer to the question "Why does Configure ask for a path to the Darwin XNU kernel header files?"

If Configure still can't find Darwin XNU kernel header files, contact me via e-mail at <abe@purdue.edu> for help. Make sure "Isof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 5.2.2 Why doesn't Apple Darwin Isof report text file information?

At the first port of Isof to Apple Darwin, revision 4.53, insufficient information was available -- logic and header files -- to permit the installation of VM space scanning for text files. As of Isof 4.70 it is still not available.

Text file support will be added to Apple Darwin Isof after the necessary information becomes available.

### 5.2.3 Why doesn't Apple Darwin Isof support IPv6?

At the first port of Isof to Apple Darwin, revision 4.53, Apple Darwin lacked IPv6 support. IPv6 became available in Apple Darwin version 1.5 and support for it was added to Isof then.

### 5.2.4 Why does Isof complain about a mismatch between the release for which Isof was compiled and the booted Mac OS X release?

When Isof is started on the "Gold Master" Darwin release

(aka Mac OS X), it complains:

lsof: compiled for 1.0 release; this is 1.3.2.

This happens because the lsof binary released with Mac OS X was built on a system whose release number (1.0) doesn't match that of the released system -- usually 1.3.x. Lsof makes this check because UNIX dialect OS changes are often accompanied by header file changes that affect lsof.

In this specific case, this error can be ignored. If you don't want to do that, get the lsof distribution and build lsof so its built-on and running-on Mac OS X release numbers match.

#### 5.2.5 Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?

Lsof for Apple Darwin 8 may report messages like these in the NAME column:

```
stat(/private/var/run/asl_prune): No such file or directory
or
stat(/private/var/db/netinfo/local.nidb/Config): Permission denied
```

Those messages indicate that lsof was unable to collect open file information for the paths enclosed in "stat(...)" with the stat(2) function, because the function encountered the reported error.

A work-around for the "Permission denied" error is to run lsof with elevated privileges -- e.g., when logged on as the super user.

If the stat(2) error message is "No such file or directory", the file probably has been unlinked (removed) and there is no lsof work-around.

#### 5.2.6 What are the limitations of Apple Darwin lsof link count reporting?

Lsof for Apple Darwin cannot report link count information reliably.

For Apple Darwin below 8 link count information is not always available in the kernel node structures available to lsof.

When link count information is available, however, it includes

link counts

of zero. Thus, using lsof's +L1 option may result in the finding of some files whose link counts are zero.

Lsof can report only some link count information for Apple Darwin 8 and above. Link count information is only available for files where lsof can assemble the full file path and has permission to apply stat(2) to it. (See the answer to the "Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?" question for more information on stat(2) failures.)

Apple Darwin 8 and above files that have been unlinked and thus have a link count of zero cannot be found by stat(2) -- i.e., stat(2) returns a "No such file or directory" error. As a result lsof never displays link counts of zero and the use of lsof's +L1 option to find them always fails.

### 5.3 Libproc-based Apple Darwin Questions

### 6.0 BSD/OS BSDI Problems

#### 6.0.5 Statement of deprecation

As of lsof revision 4.76 support for BSDI BSD/OS has been dropped. The 4.76 distribution of lsof for BSDI BSD/OS may be found on [lsof.itap.purdue.edu](http://lsof.itap.purdue.edu) in `pub/tools/unix/lsof/OLD/src`.

### 7.0 DEC OSF/1, Digital UNIX, and Tru64 UNIX Problems

#### 7.1 Why does lsof complain about non-existent /dev/fd entries?

When you run lsof for Digital UNIX 3.2, lsof may complain:

```
lsof: can't lstat /dev/fd/xxx: No such file or directory
lsof: can't lstat /dev/fd/yyy: No such file or directory
```

(Or it may warn about other missing /dev/fd paths.) When you do an `ls /dev/fd` none of the missing paths are listed.

This is caused by a bug in the DEC library function `getdirenties()`. For some reason, when /dev/fd is a file system mount point, `getdirenties()` returns an incorrect size for it to `readdir()`. (Lsof calls `readdir()` in its `ddev.c` `readdev()` function.) Because of the incorrect size,

readdir() goes past the end of the /dev/fd directory buffer, encounters random paths and returns them to lsof. Lsof then attempts to lstat(2) the random paths, gets error replies from lstat(2), and complains about the paths.

Duncan McEwan discovered this error and has reported it to DEC. Duncan also supplied an alternate readdir() function as a work-around. I've incorporated his readdir() in dialects/osf/ddev.c (as the static ReadDir() function) with some slight modifications, and enabled its use when the USELOCALREADDIR symbol is defined.

The Configure script defines USELOCALREADDIR for Digital UNIX version and 3.2. If you don't want to use Duncan's local readdir() function, edit the Makefile and remove -DUSELOCALREADDIR from the CFGF string. When DEC releases a corrected getdirentries() function, I'll modify the Configure script to stop defining USELOCALREADDIR.

## 7.2 Why does the Digital UNIX V3.2 ld complain about Ots\* symbols?

When you compile lsof on your Digital UNIX V3.2 system, ld may complain:

```
ld:
Unresolved:
knlist
_OtsRemainder32Unsigned
_OtsDivide64Unsigned
_OtsRemainder64Unsigned
_OtsDivide32Unsigned

_OtsMove
_OtsDivide32
_OtsRemainder32
*** Exit 1
```

Chris Eleveld reports this happens on Digital UNIX V3.2 systems after the Fortran compiler has been installed.

The best work-around seems to be to remove -lml from the CFGF string in the Makefile produced by Configure -- i.e., change:

```
CFGF= -lml
to
CFGF=
```

According to the V3.2 man page for nlist(3), this shouldn't work, but my testing shows that it does. Although I haven't been able to test this second work-around, you might try adding -lots to CFGL, rather than removing -lml -- i.e., change:

```
CFGL= -lml
to
CFGL= -lml -lots
```

WARNING: my testing also shows that the V2.0 nlist(3) man page means what it says when it calls for -lml -- lsof loaded without -mld under V2.0 can't locate the proc (process) table address.

DON'T REMOVE -lml FROM THE DIGITAL UNIX V2.0 MAKEFILE.

If you run into this problem, please let me know what problem you encountered and how you solved it.

### 7.3 Why can't lsof locate named pipes (FIFOs) under V3.2?

While lsof for V3.2 can report on named pipes (FIFOs), it can't find them by name. That appears to happen because of the way the V3.2 kernel lstat(2) function reports named pipe device numbers.

The V3.2 kernel reports the device number as 0xffffffff, while the kernel structures for named pipes that lsof examines contain the device number of the file system on which the named pipe resides.

Consequently, lsof can't match the device and inode number pair it receives from applying lstat(2) to the named pipe with any device and inode number pair it finds when scanning kernel structures.

I don't have a work-around. You can, of course, ask for full lsof output and use a post-processing filter (e.g., grep) to locate the named pipe of interest.

This problem doesn't exist under V2.0.

### 7.4 Why does lsof use the wrong configuration header files? For example, why can't the lsof compilation find cpus.h?

DEC

OSF/1, Digital UNIX, and Tru64 UNIX configuration header files describe the hardware and software environment for which your kernel boot file was constructed. For example, `/sys/<name>/cpus.h` defines the number of CPUs in its `NCPUS` `#define`.

Lsof searches for the configuration header file subdirectory in `/sys` (`/usr/sys` for Digital UNIX version 4.0 and Tru64 UNIX) by converting the first host name component to capital letters -- e.g., TOMIS is derived from `tomis.bio.purdue.edu`. If that subdirectory exists, lsof uses header files from it. (Configure reports what subdirectory is being used.)

If Configure doesn't find a host-name derived subdirectory, it prompts you for the entry of a subdirectory name. If you can't find one, quit Configure and run the kernel generation process to create a proper configuration subdirectory. If you don't identify a proper configuration subdirectory and you try to compile lsof, the compiler will complain about missing header files -- e.g., a missing `cpus.h`.

Once you have located or generated a proper configuration subdirectory, rerun Configure. If you have generated a configuration subdirectory whose name is derived from the host name, Configure will find and use it. If not, you will have to specify its name to Configure.

#### 7.5 Why does lsof indicate incomplete paths with "`--`" for Tru64 UNIX 5.1 files?

When lsof can't find a component of a path in the kernel's name cache (aka DNLC), or can't determine that the left-most component has as its parent the file system root, it uses an "incomplete path" notation. That notation begins with the file system root name, followed by "`--`", followed by the consecutive path name components lsof was able to find in the DNLC -- e.g., `"/ -- init`".

Because the DNLC was significantly redesigned in Tru64 UNIX 5.1, lsof's handling of the cache had to be completely redone. As part of the DNLC redesign a name cache entry parameter lsof formerly used to locate the file system root of a path was removed. With help from Chang Song I've been able to implement an alternate method for detecting the

root of these file system types: AdvFS (MSFS), CDFS, DVDFS, FDFS, NFS, NFS3, and UFS.

When lsof doesn't know how to identify the root for a file system type, it will resort to the "--" incomplete path notation.

7.6 Why doesn't lsof report link count, node number, and size for some Tru64 5.x CFS files?

lsof reports link count, node number, and size for open CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the system where lsof runs, so lsof cannot report them.

7.7 Why does lsof say it can't read the kernel name list or proc table on Digital UNIX 4.x or Tru64 UNIX?

By default on Digital UNIX 4 and Tru64 UNIX lsof reads the addresses for kernel symbols with the knlist(3) function. That function can fail, for example, when the kloadsvr daemon isn't running or is malfunctioning. When that happens, lsof may abort with one of these error messages:

```
lsof: can't read kernel name list from knlist(3): ...
```

or

```
lsof: can't read proc table info
```

The first message suggests a complete knlist(3) or kloadsvr failure; the second, a partial one.

If you know the name of the file from which the running system was booted, e.g., /vmunix, you can use lsof's -k option to direct it to read kernel symbol addresses from the name list of that file --

```
$ lsof -k /vmunix ...
```

If that works, then knlist(3) is malfunctioning and you need to fix it.

## 8.0 FreeBSD Problems

### 8.1 Why doesn't lsof report on open kernfs files?

lsof doesn't report on open FreeBSD kernfs files because



the structures lsof needs aren't defined in the kernfs.h header file in /sys/misc/kernfs.

## 8.2 Why doesn't lsof work on my FreeBSD system?

If lsof doesn't work on your FreeBSD system, first make sure you have the latest lsof revision. See the answer to the "Where do I get lsof?" question for information on how to get the latest lsof revision.

Once you have gotten the latest lsof revision, Configure and make it. If Configure fails -- e.g., it complains about an unknown FreeBSD version -- then lsof probably hasn't been ported to your FreeBSD version yet, and there's no need to go any further. Follow the answer to the "How do I report an lsof bug" to report the Configure complaint to me.

If you are able to Configure and make lsof, run its test suite. (See the answer to the "Is there a test suite?" question for more information on how to use lsof's test suite.)

If lsof still fails, make sure your kernel sources, kernel header files, kernel boot file, standard header files and libraries are synchronized. They should all be built from the same CVS refresh. (Don't forget to do a "make buildworld" followed by a "make installworld".) If they aren't, then the KVM library or lsof may be using kernel structure definitions that don't match the booted kernel; or lsof may fail to compile properly because of header files in /usr/src/sys/sys and /usr/include/sys that don't match.

If you have synchronized your kernel, header files and libraries, and still can't get lsof to work, follow the steps in the answer to the "How do I report an lsof bug" question to report the problem to me.

## 8.3 Why doesn't lsof work on the RELEASE version of CURRENT?

Lsof tracks the CURRENT release of the current leading edge FreeBSD version, because my access to leading edge FreeBSD is limited to FreeBSD.org reference systems, all running the CURRENT release.

Sometimes that tracking leads to changes in lsof that won't

work on an earlier RELEASE version of the current leading edge version.

When that happens, please send e-mail to me <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 8.4 Why does kvm\_open() complain it can't find some file?

If

lsof issues this complaint:

```
lsof: kvm_open(execfile=/boot/kernel/kernel,
corefile=/dev/mem: No such file or directory
```

Your FreeBSD system might not have a /dev/mem device. If not, create one -- e.g., as root do:

```
mknod /dev/mem c <major> 0
chmod 440 /dev/mem
chgrp kmem /dev/mem
```

For <major> use /dev/kmem's major device number.

You may have to run kldload, too -- again as root do:

```
kldload mem
```

#### 8.5 FreeBSD ZFS Problems

##### 8.5.1 Why does FreeBSD lsof report "WARNING: no ZFS support has been defined."?

Lsof issues that message when it detects a file on a ZFS file system, but has not been built with support for ZFS. Lsof's Configure script detects support can be added for ZFS when it finds this file:

```
/usr/src/sys/contrib/opensolaris/uts/common/fs/zfs/sys/zfs_znode.h
```

That header file and others in the OpenSolaris files in /usr/src enable lsof to extract information about ZFS files from the kernel structures associated with them.

#### 8.6 Why

can't Configure create lsof\_owner.h for FreeBSD 6 and above?

Lsof may report:

```
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
or
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
```

Those messages mean that lsof's Configure script failed to create a local header file, `./lockf_owner.h`, needed to use the new kernel file locking code of some versions of FreeBSD 6 and above.

The changes that implement that new locking code alter the lockf structure in `<sys/lockf.h>` and introduce a new structure, `lockf_entry`, to that header file. When Configure detects the presence of the `lockf_entry` definition in `<sys/lockf.h>`, it tries to construct the local header file, `./lockf_owner.h`.

Configure has to do that because an unfortunate side effect of the new kernel file locking code is that `<sys/lockf.h>` doesn't contain the `lockf_owner` structure definition referenced in its own lockf structure. Lsof needs to access elements of that `lockf_owner` structure to determine if a lock belongs to the process that has a file open.

The missing `lockf_owner` structure definition is in the kernel source file, typically `/usr/src/sys/kern/kern_lockf.c`. Configure tries to extract the `lockf_owner` structure definition from `kern_lockf.c` into lsof's local header file, `./lockf_owner.h`. If Configure can't do that, it reports:

```
FATAL ERROR: ./lockf_owner.h creation failed
```

If Configure can't even read `kern_lockf.c`, it first reports:

```
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c
```

The work-around for this problem is to update the FreeBSD kernel `/usr/src` tree (e.g., do a CVSup or csup) on the system where lsof is to be built and then do a "make buildworld" followed by a "make installworld".

8.6.1 Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?

If, when compiling lsof, the compiler complains with error messages like:

```
dnode.c: In function 'get_lock_state':
dnode.c:113: error: 'struct lockf' has no member named 'lf_flags'
dnode.c:115: error: 'struct lockf' has no member named 'lf_id'
...
```

Then lsof is being built on a system that has new kernel file locking code and lsof's Configure script failed to build a local lockf\_owner.h header file with a structure definition lsof needs.

See the "Why can't Configure create lsof\_owner.h for FreeBSD 6 and above?" section for more information and a work-around.

#### 8.6.2 Why don't /usr/src/sys/sys/lockf.h and /usr/include/sys/lockf.h match?

This mismatch can cause the errors explained in the answer to the "Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?" question.

If /usr/src/sys/sys/lockf.h has been updated with a CVSup or csup, the new lockf.h won't be propagated to /usr/include/sys until the "make buildworld" and "make installworld" steps have been completed.

### 9.0 HP-UX Problems

#### 9.1 What do /dev/kmem-based and PSTAT-based mean?

Lsof for HP-UX 11.0 and below uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.

Starting with HP-UX 10.10, finding definitions for the necessary kernel structures became more difficult as HP no longer distributed header files in /usr/include that defined all kernel structures. So I started "inventing" structure definitions by using Q4 to display them.

By HP-UX 11, the process of invention became extremely intensive to support. Following a patch to the ipc\_s structure in early 1999, my invented definition of that

structure became incorrect. Although I was able to devise a work-around test for the patch with Q4, it was clear that my inventions were bound to cause more problems.

Discussion with HP about the patch led to my proposing that an lsof API in the HP-UX kernel was the proper solution. Much to my surprise, HP agreed. I believe Carl Davidson was the prime mover behind that decision, but I know others participated, among them Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. I am indebted to these folks and HP for their willingness to do this work.

The API was added to the PSTAT interface in a project named PEGLE, Pstat Enhancements for Glance and Lsof. Louis and Sailu did the bulk of the design and implementation work and testing began in March, 2000

HP-UX 11.11 is the first version that provides PSTAT support for lsof. HP-UX versions in between 11.0 and 11.11 -- all Beta versions as far as I can determine -- have no lsof support.

See the "PSTAT-based HP-UX lsof Questions" section for questions and answers specific to PSTAT-based HP-UX lsof. The next section, "Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?" covers /dev/kmem-based HP-UX lsof.

The /dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/hpux branch of the lsof source tree. The PSTAT-based lsof sources may be found in .../dialects/hpux/pstat.

## 9.2 /dev/kmem-based HP-UX lsof Questions

The sources for /dev/kmem-based lsof for HP-UX may be found in lsof\_<revision>/dialects/hpux/kmem.

Lsof's Configure shell script decides to use these sources when it finds that the /usr/include/sys/pstat subdirectory doesn't exist.

Lsof can be forced to use the /dev/kmem sources by setting "/dev/kmem" in the HPUX\_BASE environment variable. Consult the Configure shell script and O0XPORTING for more information.

### 9.2.1 Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?

If you only have the standard (bundled) HP-UX C compiler and haven't purchased and installed the optional one, then you can't use cc's -O option. The HP-UX cc(1) man page says this:

"Options

Note that in the following list, the cc and c89 options

-A , -G , -g , -O , -p , -v , -y , +z , and +Z are not supported by the C compiler provided as part of the standard HP-UX operating system. They are supported by the C compiler sold as an optional separate product."

Lsof's Configure script tries to detect what C compiler product you have installed by examining your compiler. If that examination reveals a standard (bundled) compiler, lsof avoids using -O.

If the Configure compiler test fails, the C compiler will complain that it doesn't support -O. You can suppress that complaint with this make invocation:

```
$ make DEBUG=""
```

#### 9.2.2 Why doesn't the /dev/kmem-based CCITT support work under 10.x?

Pasi Kaara, who originally provided the HP-UX CCITT support, reports that it no longer works under HP-UX 10.x. Consequently, at lsof revision 4.02 it has been disabled.

#### 9.2.3 Why can't /dev/kmem-based lsof be compiled with `cc -Aa` or `gcc -ansi` under HP-UX 10.x?

Some HP-UX 10.x header files, needed by lsof, can't be compiled properly in ANSI\_C mode; structure element definition and alignment problems result. The f\_offset member of the file structure, for example, is incorrect.

This ANSI-C obstacle extends to using the -Aa option of the HP C compiler and the -ansi option of gcc.

#### 9.2.4 Why does /dev/kmem-based lsof complain about no C compiler?

Lsof's Configure script looks in /bin and /usr/ccs/bin for an HP C compiler, because it needs to know if the compiler is the standard (bundled) one or the optional separate

product. If it finds no compiler in either place, Configure quits after complaining:

```
No executable cc in /bin or /usr/ccs/bin
```

If you don't have a C compiler in either of these standard places, you should consider installing it. If you have gcc installed, you can use it by declaring the ``hpuxgcc" abbreviation to lsof's Configure script.

If you have a C compiler in a non-standard location, you can use the HPUX\_CC\_DIR[12] environment variables to name the path to it. Consult the 00XCONFIG file of the lsof distribution for more information.

#### 9.2.5 Why does Configure complain about q4 for /dev/kmem-based lsof for HP-UX 11?

When you run Configure on an HP-UX 11 system, it may complain:

```
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!
Configure can't use /usr/contrib/bin/q4 to examine the ipis_s
structure. You must do that yourself, report the result in
the HPUX_IPC_S_PATCH environment variable, then repeat the
Configure step. Consult the Configure script's use of
/usr/contrib/bin/q4 and the 00XCONFIG file for information
on ipis_s testing and the setting of HPUX_IPC_S_PATCH.
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!
```

This message states that Configure cannot use q4 from /usr/contrib/bin to examine the kernel's boot image for the ipis\_s structure. Maybe q4 hasn't been installed, or perhaps Configure can't execute it.

Lsof needs to gather information about ipis\_s to determine if the ipis\_s structure is defined in the kernel boot image, if the ipis\_s structure of the kernel boot image has an ipis\_msgsqueued member, and if the ipc\_s structure of the kernel boot image uses has an ipc\_ipis member.

The ipis\_s structure isn't described in any header file HP-UX releases with HP-UX 11. It appears in the private lsof header file ../dialects/hpux/kmem/hpux11/ipc\_s.h. Lsof gets local and remote connection addresses (IP and port numbers) from ipc\_s, so an incorrect ipc\_s definition may cause incorrect reporting of TCP/IP connection addresses.

It definitely will cause incorrect reporting on 32 bit kernels. In any case lsof should be compiled with a correct ipc\_s definition no matter the kernel bit size, so the Configure script always tests for it when the HP-UX version is 11.

For lsof's Configure script to gather the necessary ipc\_s information q4 needs to be installed in /usr/contrib/bin and the kernel boot image, /stand/vmunix, needs to have been processed with pxdB. If either is untrue, lsof issues the above error message, perhaps preceded by q4 messages. (Note: lsof's use of q4 may also fail if q4 can't execute nm -- e.g., it can't find /usr/bin/nm, or there is a conflicting, private version of nm earlier in the path.)

If /stand/vmunix hasn't been processed by pxdB, the q4 messages will include:

```
q4: (error) vmunix not pxdB'd
or
q4: (warning) /stand/vmunix has not been processed by pxdB.
```

It's possible to make a suitable private copy of /stand/vmunix for configuring lsof. That requires /opt/langtools/bin/pxdB or the q4 version of pxdB from /usr/contrib/bin/q4pxdB. The path to the result is supplied to the lsof Configure script in the HPUX\_BOOTFILE environment variable. Configure still requires /usr/contrib/bin/q4.

The following sample Bourne shell commands make a private copy of /stand/vmunix in /tmp, process it with pxdB or q4pxdB, and supply its path to lsof's Configure script in HPUX\_BOOTFILE.

```
$ cp /stand/vmunix /tmp/vmunix.lsof

$ /opt/langtools/bin/pxdB /tmp/vmunix.lsof
or
$ /usr/contrib/bin/q4pxdB /tmp/vmunix.lsof

... pxdB messages ...
$ HPUX_BOOTFILE=/tmp/vmunix.lsof Configure -n hpux
```

It may also be necessary to use q4 outside the lsof Configure script. In that case q4 can be used to determine the state of ipc\_s and ipcs with these q4 commands:



```

$ /usr/contrib/bin/q4 /stand/vmunix
...
q4> fields -c struct ipc_s
...
q4> fields -c struct ipis_s

```

Look in the q4 output for the ipc\_ipis member of the ipc\_s structure, and look in the q4 output for the ipis\_s structure for the ipis\_msgsqueued member. If ipc\_s has ipc\_ipis but ipis\_s lacks ipis\_msgsqueued, set HPUX\_IPC\_S\_PATCH environment variable to "1". If ipc\_s has ipc\_ipis and ipis\_s has ipis\_msgsqueued, set HPUX\_IPC\_S\_PATCH to "2" -- e.g.,

```

$ HPUX_IPC_S_PATCH=1 Configure -n hpux
or
$ HPUX_IPC_S_PATCH=2 Configure -n hpux

```

If ipc\_s has no ipc\_ipis member, set HPUX\_IPC\_S\_PATCH to "N" -- e.g., use this Configure step:

```

$ HPUX_IPC_S_PATCH=N Configure -n hpux

```

9.2.6 When compiling /dev/kmem-based lsof for HP-UX 11 what do the "aCC runtime: ERROR..." messages mean?

When the lsof Makefile asks the HP-UX unbundled compiler to load lsof, it may complain:

```

/bin/cc -o lsof -DHPUXV=1100 -DHASVXFS -DHPUXKERNBITS=64 \
-I/home/abe/src/lsof4/dialects/hpux/kmem/hpux11 +DD64 \
-DHAS_IPC_S_PATCH=2 -I/home/abe/src/lsof4/dialects/hpux/kmem \
-DLSOF_VSTR="B.11.00" -g dfile.o dmnt.o dnode.o dnode1.o \
dnode2.o dproc.o dsock.o dstore.o arg.o main.o misc.o \
node.o print.o proc.o store.o usage.o -L./lib -llsof -lelf \
-lnsl
aCC runtime: ERROR: Unexpected use of shared libraries
aCC runtime: ERROR: Read aCC manpage, +A option
/usr/lib/nls/loc/locales.1//is_IS.iso88591

```

This is a bug in the HP-UX national language support. (Notice the last message with "locales" in it?) Complain to HP -- then use this work-around before executing make:

```

$ unset LANG
$ make

```

9.2.7 Why doesn't /dev/kmem-based lsof for HP-UX 11 report VxFS file link counts, node numbers, and sizes correctly?

This is usually the result of running an lsof binary whose revision number is less than 4.57 on a system that has OnlineJFS support installed. It can also happen with lsof 4.57 binaries when the OnlineJFS support with which they were built doesn't match the OnlineJFS status of the system on which they are run.

The OnlineJFS status of lsof 4.57 and higher binaries can be determined by running:

```
$ lsof -v 2>&1 | grep HASONLINEJFS
```

If that shell pipe produces output, lsof was compiled with OnlineJFS support enabled; no output, disabled.

If OnlineJFS is installed on an HP-UX 11 system the /sbin/fs/vxfs/subtype executable exists and outputs "vxfs3.3" when run.

The problem occurs because the optional OnlineJFS support installation doesn't update <sys/fs/vx\_inode.h>.

Consequently

lsof can be compiled with an incorrect definition of the vx\_inode structure and look for link counts, node numbers, and sizes in the wrong places in the structure.

The current response I have gotten from HP is that no <sys/fs/vx\_inode.h> update will be provided for OnlineJFS.

I've addressed this problem temporarily with a work-around (hack) in lsof revision 4.57.

9.2.8 Why can't /dev/kmem-based lsof be built with gcc for 64 bit HP-UX 11?

When Configure is given the "hpuxgcc" abbreviation, the HP-UX version is 11, and the kernel bit size is 64, the lsof Configure script may abort with the messages:

```
!!!!!!!!!!!!!!!! FATAL ERROR !!!!!!!!!!!!!!!!!
```

```
APPARENTLY GCC CANNOT BUILD 64 BIT EXECUTABLES.
A COMPILER MUST BE USED THAT CAN. SEE 00FAQ
FOR MORE INFORMATION.
```

(This is the "more information" in 00FAQ.)

This means the Configure script compiled a test program with gcc the result wasn't an ELF-64 binary. Lsof tries two gcc modes, one with no options and another with the -mlp64 option, before it concludes gcc can't be used.

See the "How can I acquire a gcc for building lsof for 64 bit HP-UX 11?" answer for information on where you might be able to get a gcc for HP-UX 11 that can produce ELF-64 executables.

#### 9.2.8.1 How can I acquire a gcc for building lsof for 64 bit HP-UX 11?

Check this HP URL:

[http://h21007.www2.hp.com/dspp/tech/tech\\_TechSoftwareDetailPage\\_IDX/1,1703,547,00.html](http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,547,00.html)

(That's one very long link; be careful you cut 'n paste it all.)

In November 2001 that URL led to a web page whose title was "gcc for hp-ux 11." The page offered a link for downloading a 64 bit gcc 3.0 compiler for HP-UX 11.0 and 11i. Rich Rauenzahn of HP installed that compiler on an HP test system he allows me to use and I successfully built a 64 bit lsof with it.

The HP package may install the 64 bit capable gcc in /usr/local/pa20\_64/bin/gcc, so you may have to adjust your path or set the LSOF\_CC environment variable to compensate.

#### 9.2.9 Why does /dev/kmem-based lsof for HP-UX 11 report "unknown file system type" for some open files?

The lsof binary being used probably doesn't have support for the VxFS file system.

To confirm that, check `lsof -v` output for "-DHASVXFS". If it's not present, lsof doesn't have VxFS support.

You also need to establish that lsof really is complaining about VxFS files by checking the kernel boot file for the symbol associated with the hexadecimal address reported in the "unknown file system type" message -- e.g., "v\_op: 0x8711c8."

Use nm(1) to do that:

```
$ nm -x /stand/vmunix | grep 8711c8
```

If nm reports the symbol associated with the address is vx\_vnodeops, then lsof is complaining about an open VxFS file.

The solution in that case is to build lsof yourself (The bundled C compiler will do it.), making sure that lsof's Configure script detects the presence of VxFS. Configure does that by finding these two header files:

```
/usr/include/sys/fs/vx_hpux.h
/usr/include/sys/fs/vx_inode.h
```

If the system where you are building lsof doesn't have those header files, but does have VxFS, you might be able to install the header files by installing the HP JournalFS package from the CoreOS CD -- in particular the file set JournalFS.VXFS-PRG and its associated patch, PHKL\_18543. (My thanks to Steve Bonds for that information.)

Finally, if you find that lsof isn't complaining about VxFS when it complains about an unknown file system type, send e-mail to me <abe@purdue.edu> for further assistance. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 9.2.10 Why does the ANSI-C compiler complain about comments in HP-UX 11 header files?

When compiling lsof on HP-UX 11, the HP ANSI-C compiler's pre-processor, cpp, may complain about comments in HP-UX header files -- e.g.,

```
cpp: "/usr/include/sys/cdfs.h", line 232: warning 2028:
Found comment
inside comment started on line 232.
```

```
cpp: "/usr/include/sys/cdnode.h", line 196: warning 2028:
Found comment inside comment started on line 196.
```

```
cpp: "/usr/include/nfs/snnode.h", line 30: warning 2028:
Found comment inside comment started on line 30
```

This is not a problem with lsof. It is a problem with the HP-UX header files; they have non-compliant ANSI-C comment sequences in them -- e.g.,

```
<sys/cdfs.h>: 232
/* struct cdfs *cdfs_link; /* linked list of file systems */
```

The initial "/\*" is not terminated by an ending "\*/" before the appearance of a second "/\*".

9.2.11 Why does `dnodel.c` cause the HP-UX 11 compiler to complain that `<sys/fs/vx_inode.h>` is missing or incorrect?

If CFLAGS in the `lsof` Makefile for an HP-UX 11 compilation includes `HASONLINEJFS`, indicating the system has OnlineJFS support, `lsof` needs the `<sys/fs/vx_inode.h>` header file. Sometimes it is missing from `/usr/include/sys/fs`.

`<sys/fs/vx_inode.h>` is a header file that must be obtained from Veritas. If that proves impossible, please contact me via e-mail at `<abe@purdue.edu>`. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 9.3 PSTAT-based HP-UX `lsof` Questions

The sources for PSTAT-based `lsof` for HP-UX may be found in `lsof_<revision>/dialects/hpux/pstat`.

`lsof`'s Configure shell script decides to use these sources when it finds that the `/usr/include/sys/pstat` subdirectory exists.

`lsof` can be forced to use the PSTAT-based sources by setting "pstat" in the `HPUX_BASE` environment variable. Consult the Configure shell script and `OOXPORTING` for more information.

9.3.1 Why does PSTAT-based `lsof` complain about `pst_static` and other PSTAT structures?

When `lsof` starts it may issue one of these fatal error messages:

```
lsof: FATAL: can't determine PSTAT static size
lsof: FATAL: can't read <n> bytes of pst_static
lsof: FATAL: pst_static doesn't contain <name>_size
lsof: FATAL: <name>_size
should be <n>
```

These messages indicate that `lsof`'s tests for the proper

level of PSTAT support have failed. The structure names, given in <name>, and sizes, given in <n>, identify the support deficiency more precisely.

You may need to upgrade the PSTAT support in your kernel to be able to use PSTAT-based lsof.

### 9.3.2 Why does PSTAT-based lsof complain it can't read pst\_\* structures?

Lsof may put messages like the following in the NAME column of its output.

```
can't read cwd pst_filedetails: Permission denied
can't read mem pst_filedetails: Permission denied
can't read rtd pst_filedetails: Permission denied
can't read txt pst_filedetails: Permission denied
can't read pst_filedetails: Permission denied
can't read 3 stream structures: Permission denied
can't read pst_socket: Permission denied
```

These messages indicate that the lsof binary lacks the authority to read the name structures for processes other than ones belonging to the UID under which lsof is running.

Authority to read the structures of other processes is limited to root processes -- i.e., lsof must have setuid-root permission if it is to list open files for arbitrary processes.

If you want to eliminate these errors, you must run lsof as root or install it with setuid-root permission.

### 9.3.3 Why does PSTAT-based lsof rebuild the device cache file after each reboot?

After each HP-UX rebuild, the first time a user runs lsof it will report:

```
lsof: WARNING: device cache mismatch: /dev/tun...
lsof: WARNING: created device cache file: /<user_path>
```

This happens because the device numbers on /dev/tun\* device nodes are recalculated at each reboot. When lsof detects a change in the device number of a /dev/tun\* file, it rebuilds its local device cache file.

### 9.3.4 Why doesn't PSTAT-based lsof report TCP addresses for

telnetd's open socket files?

When lsof can't report TCP addresses for telnetd's open socket files it is because an unpatched PSTAT kernel interface doesn't report the addresses to lsof.

This has been addressed in PSTAT kernel patch PHKL\_24047. It is available from the HP IT Resource Center at:

<http://itrc.hp.com>

In the page's "maintenance / support" box select the "individual patches" link. Once at its page, select the "hp-ux" link. On that page select the "Series 800" or "Series 700" radio button and select "11.11" from the pull-down list to the right of the button. Under "search or browse the path list" select "Search by Patch IDs" from the pull down list, enter PHKL\_24047 in the following text box, and select search. That should lead to information about PHKL\_24047 and a link for downloading it. (You may have to log in first and you may have to create a login identity by registering before you can log in.)

Some time in March 2006 the PHKL\_24047 patch was "lost" by the HP-UX networking lab. It has been "found" again in August 2006 and will be re-released as a GRO patch "some time." I don't yet know when that will be. You must contact HP to learn about the availability of the GRO patch.

#### 9.3.5 Why does PSTAT-based lsof cause an HP-UX 11.11 kernel panic?

When PSTAT-based lsof runs on some HP-UX 11.11 kernels, the kernel may panic. Symptoms include:

Console message:

```
0xFBE000301100EF00 00000000 0000EF00 -
type 31 = legacy PA HEX chassis-code
```

/var/adm/syslog:

```
... vmunix: Trap Type 15 (Data page fault)
... vmunix: Instruction Address (pcsq.pcoq) = 0x...
```

The panic is caused by a bug in the way PSTAT's pstat\_getstream() function obtains module names from streams managed by the otsam stream driver (part of OSI Transport Services). Lsof

calls `pstat_getstream()` when it encounters an open `otsam` stream file. An HP-UX 11.11 system uses `otsam` if `otsam` appears in `/stand/system`.

HP-UX 11.11 patch `PHKL_24507` (available some time after July 15, 2001) fixes the `pstat_getstream()` bug. See the information in the answer to the "Why doesn't PSTAT-based `ls` report TCP addresses for `telnetd`'s open socket files?" question for information on how to obtain the patch.

### 9.3.6 Why doesn't PSTAT-based `ls` report a CWD that is on a loopback (LOFS) file system?

When PSTAT-based `ls` reports on processes whose current working directory (CWD) is on a loopback file system, `ls` can't report the open CWD file. The reason is that the HP-UX 11.11 and above kernel's loopback file system code is not passing the CWD file ID to the kernel's `pstat(2)` code. Hence `ls` is given no information on the `lofs` CWD.

The problem was first reported to me by Ermin Borovac and an internal bug report was filed with the HP-UX file system group on October 26, 2004. That report has now been answered by the patch `PHKL_33200 -- s700_800 11.11 lofs cumulative patch`. The HP IT Resource Center (<http://itrc.hp.com>) is a source for the patch.

### 9.3.7 Why do some `swinstall` packages for PSTAT-based HP-UX 11.11 complain about `setgid` and `setuid` bits?

First, let me explain that I do not provide `ls` `swinstall` packages for `ls`. Others provide them and they should be contacted about problems with their packages.

However, I have become aware of a problem with one package about which I have some information I can share. The problem shows up in these `swinstall` messages:

```
ERROR: Unknown owner and/or group for file
"/usr/local/bin/ls". SUID and/or SGID bit was
not set.
ERROR: Failed installing fileset "ls.ls-RUN,r=4.73".
Check the above output for details.
```

The `swpackage` SUID/SGID functionality was restricted by changes for POSIX compliance, breaking backward compatibility. The



patch PHCO\_27671 allows SUID/SGID for uid/gid of 0 only, as a compromise between backward compatibility and POSIX conformance.

If the setuid bit is to be set on the executable, the UID and GID of the executable must be 0 (zero).

### 9.3.8 Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?

A PA-RISC HP-UX 11.23 bundled C compiler dated May 2005 or later will not build PSTAT-based lsof. It will deliver error messages related to the system's <gssapi/gssapi.h> header file.

There is nothing wrong with that header file or lsof. The problem is that the bundled C compiler can't cope with the gssapi.h header file.

The work-around is to use the HP ANSI C compiler. Using gcc is not a satisfactory work-around. See the answer to the "Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?" question for more information.

### 9.3.9 Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?

Gcc will not even compile PSTAT-based lsof revisions below 4.77 for PA-RISC HP-UX 11.23 dated May 2005 or later. It reports errors in lsof's print.c fill\_portmap() function about missing members of the rpercent structure. That happens because gcc defines \_XOPEN\_SOURCE\_EXTENDED which disables the definition of the rpercent structure in <netdb.h>.

Using the HP bundled C compiler is not a viable work-around. That is explained in the answer to the "Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?"

While an lsof revision 4.77 or higher can be compiled with gcc, the results are unreliable. lsof will compile, but it occasionally produces segment faults when it runs. I have not been able to reproduce the failure reliably or locate a debugger that will work with the gcc-compiled lsof.

The only reliable work-around is to use the HP ANSI C compiler.

### 9.3.10 Why does PSTAT-based lsof complain, "FATAL: pst\_stream\_size

should be: 672; is 72" on HP-UX 11.11 and above?

This message indicates a mismatch between the PSTAT header files used to build lsof (<sys/pstat.h> and those in the /usr/include/sys/pstat subdirectory), and those that built the running kernel.

Unfortunately the June 2008 patch set for HP-UX 11.23 creates this inconsistency, because it does not contain all the patches needed to match the kernel with the PSTAT header files. Even more serious is that the missing patches update the kernel's PSTAT support to provide TCP/UDP endpoint information to lsof from TCP/TLI streams.

The patch inconsistency comes about because, while the following patch is installed,

PHKL\_36577 1.0 PM-PSTAT section 2 manpage changes

other kernel patches are not.

The PHKL\_36577 patch updates the PSTAT header files and manual pages to match kernel changes that other patches with the following numbers (or patches that contain or supersede them) contain:

PHNE\_36575 1.0 Cumulative STREAMS Patch  
PHNE\_37670 1.0 cumulative ARPA Transport patch  
PHNE\_37851 1.0 NFS cumulative patch

Those patches implement the kernel changes that support the delivery of information promised in patch PHKL\_36577.

The work-around is to install the missing patches.

#### 9.4 Why won't the HP-UX depot install?

I don't distribute lsof depots, so  
I can't support them.

From time to time depots prepared by various sites -- e.g., usually HP-UX software collection sites -- will contain errors that cause installation of the depot to fail.

Do not contact me when this happens. Instead, contact the administrator of the site that prepared the depot.

As should be clear from the bulk of the lsof documentation, I do not recommend you use pre-built lsof binaries in any form. Instead, I recommend you obtain the lsof source distribution and build lsof yourself.

## 10.0 Linux

### 10.1 What do /dev/kmem-based and /proc-based lsof mean?

At approximately Linux 2.1.72 and exactly at lsof revision 4.23 support for Linux forks. The first fork, containing the oldest lsof form is based on access to kernel memory structures, and is called /dev/kmem-based lsof. A /dev/kmem-based lsof is heavily intertwined with the Linux kernel version, its header files, and its system map file. Typically a /dev/kmem-based lsof needs only setgid permission to local all open file information.

After approximately Linux 2.1.72 and at revision 4.23 lsof obtains all its information from the /proc file system. That lsof is called the /proc-based lsof. A /proc-based lsof does not read kernel memory, needs neither kernel header files nor the system map file, and is less likely to be affected by Linux kernel changes. However, it does require setuid-root permission to list all open files, and it can't report file offsets (positions).

After revision 4.52 the /dev/kmem-based Linux sources for lsof are no longer distributed. Information about them may be found in the 00INDEX and README files at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/src>

### 10.2 /proc-based Linux lsof Questions

#### 10.2.1 Why doesn't /proc-based lsof report file offsets (positions)?

/proc-based lsof revisions 4.79 and above can only report file offsets (positions) for the files of Linux kernels 2.6.22 and above.

During its initialization /proc-based lsof tests to see if offset information can be obtained. If it cannot, lsof disables offset reporting. If the -o option was selected, lsof also issues this warning:

lsof: WARNING: can't report offset; disregarding -o.

10.2.2 Why does /proc-based lsof report "can't identify protocol" for some socket files?

/proc-based lsof may report:

```
COMMAND PID ... TYPE ... NODE NAME
pump 226 ... sock ... 309 can't identify protocol
```

This means that it can't identify the protocol (i.e., the AF\_\* designation) being used by the open socket file. Lsof identifies protocols by matching the node number associated with the /proc/<PID>/fd entry to the node numbers found in selected files of the /proc/net sub-directory. Currently /proc-based lsof examines these protocol files:

```
/proc/net/ax25 (untested)
/proc/net/ipx (needs kernel patch)
/proc/net/raw
/proc/net/raw6
/proc/net/tcp
/proc/net/tcp6
/proc/net/udp
/proc/net/udp6

/proc/net/unix
```

If /proc-based lsof says it can't identify the protocol for an open socket file, you may be able to identify the protocol yourself by using `grep` to look for the specific node number in the files of /proc/net -- e.g.,

```
$ grep <node_number> /proc/net/*
```

You may not be able to find the desired node number, because not all kernel protocol modules fully support /proc/net information.

If you find a matching node number in a /proc/net file that is not currently being processed by lsof, contact me via e-mail at <abe@purdue.edu>. I'll discuss adding support to /proc-based lsof for the protocol of the /proc/net file with you. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

The code that matches node numbers of open IPX protocol socket files to those in /proc/net/ipx requires Jonathan Sergent's Linux 2.1.79 patch to /usr/src/linux/net/ipx/af\_ipx.c. The patch, suitable for input to Larry Wall's patch program, may be found in the lsof distribution file:

```
.../dialects/linux/proc/patches/net_ipx_af_ipx.c.patch
```

### 10.2.3 Why does /proc-based lsof warn about unsupported formats?

lsof may issue the following warning:

```
lsof: WARNING: unsupported format: /proc/net/<file>
```

if the header line of the indicated <file> in /proc/net -- ax25, ipx, raw, tcp, udp, or unix -- doesn't match what lsof expects to find.

When the header line of a /proc/net file isn't what lsof expects, lsof probably can't parse the rest of the file correctly and doesn't try. As a result, lsof can't report any NAME column information (e.g., local and remote addresses) for socket files bound to the indicated network protocol.

If you get this warning, please send me e-mail at <abe@purdue.edu>. Include the contents of the file lsof claims has an unsupported format. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 10.2.4 Why does /proc-based lsof report "(deleted)" after a path name?

The "(deleted)" notation following a path name in /proc-based lsof's NAME column comes from the /proc/<PID>/fd/<FD> entry for the open file. It's the Linux kernel's way of indicating the file is open but has been unlinked (rm'd).

### 10.2.5 Why doesn't /proc-based lsof report full open file information for all processes?

/proc-based lsof can only report on processes whose /proc files it has permission to read. /proc normally grants permission to read all its files only to root or to the owning user ID.

Without permission to read most /proc files, lsof can only report full information for processes belonging to the user

who is running lsof. /proc-based lsof may be able to report some information for all processes, depending on the permissions of their associated /proc files, but usually /proc-based lsof won't be able to access the files in /proc/<PID>/fd/ that describe regular open files.

If you want /proc-based lsof to report on all processes, you must install it with setuid-root permission.

#### 10.2.6 Why won't Customize offer to change HASDCACHE or WARNDEVACCESS for /proc-based lsof?

/proc-based lsof doesn't read device information from /dev or the device cache file, so it makes no sense to change the state of device cache processing or /dev node accessibility warnings.

#### 10.2.7 /proc-based lsof Linux NFS questions

##### 10.2.7.1 Why can't lsof find files on an accessible NFS file system?

On occasion lsof may be unable to identify that an open file is on an NFS file system. This is most likely the result of a bug in the way the Linux kernel supplies information to the reader of /proc/mounts (lsof) -- sometimes that pseudo-file is truncated by the kernel.

One way to see if this is the case is to search for the NFS file system in /proc/mounts -- e.g.,

```
$ grep <NFS_file_system_mount_point> /proc/mounts
```

If you get no output or the third word of the output isn't "nfs", then lsof won't consider the file system an NFS file system.

A second test is to look at the end of /proc/mounts -- e.g.,

```
$ tail /proc/mounts
```

If tail reports "# truncated" then /proc/mounts is incomplete because of a Linux kernel bug. The bug is documented at:

<http://www.xss.co.at/sysinfo/mounts.html>

The bug is fixed in Linux kernel 2.4.18, and possibly in some earlier Linux kernel versions.

#### 10.2.7.2 Why can't lsof find files on an inaccessible NFS file system?

If lsof issues this message about a Linux file system, mounted from an NFS server:

```
lsof: WARNING: can't stat() nfs file system /xxx/yyy
```

Then lsof won't be able to find any open files on the file system.

That's because of an inadequacy in the Linux /proc file system. Its /proc/mounts file doesn't give the device doublet (major and minor numbers) of the file system as do many UNIX systems (e.g., Solaris). The only way lsof can get the device doublet for a Linux file system is to call stat(2) on the file system path, which fails if the NFS server isn't accessible.

When lsof doesn't know the device doublet of a file system, it can't find open files on the inaccessible file system, because it can't match the doublets of open files to the doublet of the inaccessible file system.

This topic is covered extensively in lsof(8) in its ALTERNATE DEVICE NUMBERS and BLOCKS AND TIMEOUTS sections.

#### 10.2.8 Why doesn't /proc-based Linux lsof report socket options and values, socket state flags, and TCP options and values?

The Linux /proc file system doesn't report socket options and values, socket states, and TCP options and values to lsof.

#### 10.2.9 Does /proc-based Linux lsof use a device cache?

No. The Linux /proc/<PID>/fd/\* entries provide device names to lsof via readlink(2). It is not necessary to enable device cache processing for /proc-based Linux lsof via the Customize script or modifications to the Linux machine.h header file.

#### 10.2.10 Why doesn't /proc-based Linux lsof report any or all file structure values for its +fcfgn option?

/proc-based lsof revisions 4.79 and above can only report some file structure values for Linux kernels below 2.6.22.

When running on Linux kernels at 2.6.22 and above lsof 4.79 can report some file flag values -- i.e., in response to the +fg or +fG options. The flag values are obtained from the /proc/<PID>/fdinfo/ files introduced at Linux kernel 2.6.22.

/proc-based Linux lsof tests its availability to obtain file flag values at initialization. If values are not available, lsof disables file flag reporting. If the flags were requested with +fg or +fG, lsof displays this warning:

```
lsof: WARNING: can't report file flags; disregarding +f.
```

As a special note, when Linux lsof can report flag bits, it will not report 'R' for a read-only file. There is no read-only flag bit O\_\* symbol in <fcntl.h> (or <bits/fcntl.h>) and lsof reports only bits that are set. The absence of O\_RDWR and O\_WRONLY flag bits implies the file is read-only.

### 10.3 Special Linux file types

#### 10.3.1 Why is ``DEL" reported as a Linux file type?

Lsof usually reports entries from the Linux /proc/<PID>/maps file with ``mem" in the TYPE column. However, when lsof can't stat(2) a path in the process' ``maps" file and the ``maps" file entry contains ``(deleted)", indicating the file was deleted after it had been opened, lsof reports the file type as ``DEL".

#### 10.3.2 Why is ``unknown" reported as a Linux file type?

Lsof may report a Linux file's type as ``unknown" in the TYPE column when lsof can't obtain complete stat(2) results for the file.

Usually the NAME column will contain a ``(stat: xxx)" error message, but that could have been suppressed with the lsof ``-w" option.

### 10.4 Linux ``mem" Entry Problems

#### 10.4.1 What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?



When the device or inode number in the process' ``maps" file entry doesn't match the stat(2) results from the file path, lsof reports the inconsistent information from the stat(2) of the path parenthetically after the path in the NAME column in one of these forms:

(path dev=xxx)            only the device number, ``xxx", from a stat(2) of the ``maps" file entry path differs from the ``maps" file entry value reported in the DEVICE column.

(path inode=yyy)        only the inode number, ``yyy", from a stat(2) of the ``maps" file entry path differs from the ``maps" file entry value reported in the NODE column.

(path dev=xxx inode=yyy) Both device and inode numbers differ.

lsof reports the ``maps" file device number in the DEVICE column and the inode number in the NODE column.

When device and inode mismatches occur, lsof suppresses the reporting of link count and size. See the answer to the "Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?" question for more information.

Device and inode inconsistencies can occur when a file at a ``maps" path is replaced after the process has started, or when a different file system with similar path names is mounted on top of the original file system.

The device inconsistency parenthetical messages can be suppressed with lsof's ``-w" option.

#### 10.4.2 Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?

Link count and size are not reported for some entries from the process' ``maps" file because a stat(2) of the entry file path failed or stat(2) delivered device or inode numbers that don't match the ones in the ``maps" entry.

When the stat(2) device or inode numbers don't match those in the ``maps" file entry, it is likely that the stat(2) results don't apply to the file that was originally mapped by the process and whose path appears in the ``maps" file entry, so lsof tries to avoid reporting possibly incorrect information.

See

the answer to the "What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?" for more information on how mismatched stat(2) device and inode numbers are reported.

## 10.5 Special Linux NAME column messages

### 10.5.1 What does ``(stat: xxx)" mean in the NAME column of Linux files?

When lsof tried to stat(2) the path in the NAME column, the stat(2) system call failed and produced an error message of ``xxx".

This situation usually occurs if the lsof process lacks permission to stat(2) the path -- e.g., the lsof executable lacks root permission, or lsof is attempting to stat(2) a path on an NFS device mounted with the root\_squash option.

The message can be suppressed with lsof's ``-w" option.

### 10.5.2 What does ``(readlink: xxx)" mean in the NAME column of Linux files?

When lsof tried to convert the /proc/<PID>/fd path, reported in the NAME column, to its full and more meaningful path, the readlink(2) system call used to do the conversion failed. The readlink(2) failure message is ``xxx".

This situation usually occurs if the lsof process lacks permission to readlink(2) some part of the path -- e.g., the lsof executable lacks root permission, or lsof is attempting to stat(2) a path on an NFS device mounted with the root\_squash option.

The message can be suppressed with lsof's ``-w" option.

### 10.6 Why is ``NOFD" reported as a Linux file type?

When lsof lacks permission to use opendir() on the fd/ subdirectory of a process' /proc/<PID> directory, it reports a single file of the type ``NOFD" (for no file descriptors).

Lsof reports the the /proc/<PID>/path in the NAME column, followed by "(opendir: xxx)", where ``xxx" is the error message returned by opendir().

The ``NOFD" entry can be suppressed with lsof's ``-w" option.

## 10.7 Why does Linux lsof report a NAME column value that begins with ``/proc"?

When lsof has problems processing a ``/proc/<PID>" entry -- e.g., it can't convert the entry to a full and more meaningful path name, or it can't access the /proc/<PID>/fd subdirectory with opendir() -- it will report the /proc/<PID> path in the NAME column.

## 10.8 Linux /proc/net/tcp\* and /proc/net/udp\* issues

### 10.8.1 Why use the Linux -X option?

If you're not interested in TCP/IP socket information for a particular use of lsof, adding the -X option will make lsof run more quickly, because -X inhibits the reading of the /proc/net/tcp\* and /proc/net/udp\* files. For example, you may only be interested in knowing what process has a particular file open.

When the Linux system has a large number of open TCP/IP socket files, the time savings provided by -X can be significant.

### 10.8.2 Why does lsof say ``-i is useless when -X is specified"?

If -X is specified, lsof can't report much information on open TCP/IP socket files. However, lsof's -i option requests that information. Hence, the two options conflict and can't be used together.

### 10.8.3 Why

does lsof say ``can't identify protocol (-X specified)"?

If the Linux lsof -X option is specified and an open socket file can't be identified without accessing the /proc/net/tcp\* and /proc/net/udp\* files, lsof will report that it can't identify the socket's protocol and that the failure may be

caused by the -X specification

## 11.0 NetBSD Problems

### 11.1 Why doesn't lsof report on open kernfs files?

Lsof doesn't report on open NetBSD kernfs files because the structures lsof needs aren't defined in the kernfs.h header file in /sys/misc/kernfs.

### 11.2 Why doesn't lsof report on open files on: file descriptor file systems; /proc file systems; 9660 (CD-ROM) file systems; MS-DOS (floppy disk) file systems; or kernel file systems?

Lsof is not able to report on open files on certain file system if /usr/src/sys/msdosfs didn't exist when the lsof Configure script ran and lsof was made. /usr/src/sys/msdosfs contains header files lsof needs for collecting data on certain file system files.

You can tell if an lsof executable above) lacks support for a file system if the following test of `lsof -v` produces nothing:

```
$ lsof -v 2>&1 | grep <support_enabled_definition>
```

The <support-enabled\_definition> will be:

```
File System Type Definition Note

File descriptor HASFDESCFS
/proc HASPROCFS
9660 HAS9660FS
MS-DOS HASMSDOSFS (lsof 4.61 and above)
Kernel HASKERNFS
```

The work-around is to install /usr/src/sys, rerun the lsof Configure script, and remake lsof.

### 11.3 Why does lsof produce confusing results for nullfs file systems?

Consider this report from /sbin/mount:

```
/usr/home on /home type null (local)
```

(According to `/sbin/mount /usr/home` is the mounted-on device and `/home` is the mounted-on directory.)

When `lsdf` is asked to report on open files on `/home`, it will report them as files on `/usr/home` instead. That's an artifact of the NetBSD kernel's dynamic name lookup cache (DNLC) and the way the kernel handles nullfs mounted-on directories.

While `lsdf` will report all open files on `/home` when given `/home` as a file system directory argument, even though reporting them as located on `/usr/home`, `lsdf` will not find the same files when asked to report on all open files on `/usr/home` when given `/usr/home` as a file system device argument. That's because from the mount perspective `/usr/home` is equivalent to a device, but from the device perspective it is still a directory.

So, what this `lsdf` command reports:

```
$ lsdf /home
... NAME
... /usr/home/...
```

Won't be duplicated by this `lsdf` command:

```
$ lsdf /usr/home
```

Another way to look at this confusing `/home` and `/usr/home` example is to consider what `stat(2)` reports. For `/home` `stat(2)` reports a device doublet that matches what `lsdf` finds in open file node structures, while the device doublet `stat(2)` reports for `/usr/home` won't match what `lsdf` finds. Nor does the mode reported by `stat(2)` indicate a block devices, as is the expected case.

There is no simple answer to this confusion, nor is there even a simple explanation. Simply be aware that when supplying file system arguments to `lsdf` on NetBSD, use the mounted-on directory name for a nullfs as the `lsdf` argument, and don't be surprised when the `NAME` column reports the mounted-on device name.

## 11.4 NetBSD header file problems

### 11.4.1 Why can't the compiler find some NetBSD header files?

If the compiler's pre-processor complains it can't find some header files when it compiles lsof source files, /usr/include and /usr/src may not have all the header files lsof needs.

As a work-around use the NETBSD\_SYS environment variable to specify to lsof the location of the additional header files -- e.g.,

```
% setenv NETBSD_SYS /my_source
% ./Configure -n netbsd
```

or

```
$ NETBSD_SYS=/mys_source ./Configure -n netbsd
```

Caution: using this work-around may cause the lsof Configure script

to activate or omit different features, depending on where it finds the header files that determine the state of the features.

#### 11.4.2 Why does NetBSD lsof produce incorrect output?

If the NetBSD system's kernel was built from header files that don't match those in /usr/include -- e.g., //usr/src has the ones from which the kernel was built -- lsof may build, but won't produce correct output.

As a possible work-around, try directing the C compiler to select header files from /usr/src before it selects them from /usr/include. That can be done with the DEBUG make string -- e.g.,

```
$ make DEBUG="-I/usr/src -I/usr/include"
```

If that work-around fails, try using the LSOF\_INCLUDE and NETBSD\_SYS environment variables to swap /usr/include and /usr/src when running the Configure script, then use the make DEBUG string when running make -- e.g.,

```
$ LSOF_INCLUDE=/usr/src; export LSOF_INCLUDE
$ NETBSD_SYS=/usr/include; export NETBSD_SYS
$./Configure -n
netbsd
$ make DEBUG="-I/usr/src -I/usr/include"
```

#### 11.5 Why isn't lsof feature xxx enabled for NetBSD?

Lsof's Configure script enables NetBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See 00PORTING for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree lsof is searching is incomplete or out of date.

Lsof normally looks for NetBSD header files in /usr/include. It can also be directed to look in other directories -- e.g., /sys -- if told to do so with the contents of the LSOF\_INCLUDE and NETBSD\_SYS environment variables.

To determine what header file enables a missing feature, check the NetBSD stanza in the Configure script. Then check the locations it checks for the indicated header files and contents.

See 00XCONFIG for more information on LSOF\_INCLUDE and NETBSD\_SYS.

## 12.0 NEXTSTEP and OPENSTEP Problems

### 12.1 Why can't lsof report on 3.1 lockf() or fcntl(F\_SETLK) locks?

Lsof has code to test for locks defined with lockf() or fcntl(F\_SETLK) under NEXTSTEP 3.1, but that code has never been tested. I couldn't test it, because my NEXTSTEP 3.1 lockf() and fcntl(F\_SETLK) functions return "Invalid argument" every way I have tried to invoke them.

If your NEXTSTEP 3.1 system does allow you to use lockf() and fcntl(F\_SETLK) and lsof doesn't report locks set with them, then the code in ../dialects/next/dnode.c probably isn't correct. Please contact me via e-mail at <abe@purdue.edu> and tell me how you got your lockf() and fcntl(F\_SETLK) system calls to work. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 12.2 Why doesn't lsof compile for NEXTSTEP with AFS?

I no longer have a NEXTSTEP test system that has AFS. Changes to lsof since I once had a test system

have caused me to change the AFS code in NEXTSTEP without being able to test the changes.

If you need AFS support for NEXTSTEP and can't get it to compile, please contact me. Perhaps we can jointly fix the problems.

## 13.0 OpenBSD Problems

### 13.1 Why doesn't lsof support kernfs on my OpenBSD system?

Lsof supports the kernel file system on OpenBSD versions whose `/sys/miscfs/kernfs/kernfs.h` (or `<miscfs/kernfs/kernfs.h>`) header file correctly defines the `kern_target` structure. The lsof Configure script's `openbsd` stanza checks for the presence of the structure's `kt_name` element and activates kernfs support for the `CFLAGS -DHASKERNFS` definition only when it finds `kt_name`.

The `kernfs.h` header file is scheduled to be updated in the OpenBSD 2.1 release, according to Kenneth Stailey, who authored its changes.

### 13.2 Will lsof work on OpenBSD on non-x86-based architectures?

I've not tested lsof on an OpenBSD system that uses a non-x86-based architecture, but I've had one report that lsof 4.33 compiles and works on OpenBSD for the pmax architecture (decstation 3100).

### 13.3 `<sys/pipe.h>` problems

#### 13.3.1 Why does the compiler claim `nbpq` isn't defined?

When compiling lsof on some (older) OpenBSD SPARC versions, the compiler may complain:

```
In file included from ../dlsof.h:191,
 from ../lsof.h:166,
 from fino.c:52:
/usr/include/sys/pipe.h:83: `nbpq' undeclared here
(not in a function)
/usr/include/sys/pipe.h:83: size of array `ms' has
non-integer type
```



This happens because `<sys/pipe.h>` uses NBPG from `<machine/param.h>` to size the ``ms'` array, and some OpenBSD systems define NBPG in terms of a kernel integer variable, `nbpg`.

Lsof revisions 4.46 and above have a hack to `dlsof.h`, developed by Volker Borchert that avoids the compiler problem for SPARC OpenBSD 2.3. The hack might work for other OpenBSD SPARC versions, but hasn't been tested there.

If you want to enable the hack for your OpenBSD SPARC version, modify this code in `.../dialects/n+obsd/dlsof.h`:

```
if defined(OPENBSDV)
if OPENBSDV==2030 && defined(__sparc__)
if defined(nbpg)
#undef nbpg
endif /* defined(nbpg) */
#define nbpg 4096 /* WARNING!!! ... */
endif /* OPENBSDV==2030 && defined(__sparc__) */
#include <sys/pipe.h>
#endif /* defined(OPENBSDV) */
```

You will probably want to change the second `#if` test to match your OpenBSD version. You may also want to change what value is assigned to `nbpg`. See the next section, "What value should I assign to `nbpg`?"

### 13.3.2 What value should I assign to `nbpg`?

If you need to enable the `nbpg` hack, described in "Why does the compiler claim `nbpg` isn't defined?", you may also need to assign a value other than 4096 to `nbpg`. 4096 works for the sun4c processor and should work for sun4m, but 8192 may be needed for sun4.

Check `<machine/param.h>` and other OpenBSD documentation to determine the correct `nbpg` assignment.

### 13.4 Why doesn't lsof report on open MS-DOS file system (floppy disk) files?

Lsof is not able to report on open MS-DOS file system files if `/usr/src/sys/msdosfs` didn't exist when the lsof Configure script ran and lsof was made. `/usr/src/sys/msdosfs` contains header files lsof needs for collecting data on MS-DOS file

system files.

You can tell if an lsof executable (revisions 4.61 and above) lacks MS-DOS file system support if the following command reports nothing:

```
$ lsof -v 2>&1 | grep HASMSDOSFS
```

The work-around is to install `/usr/src/sys`, rerun the lsof Configure script, and remake lsof.

### 13.5 Why isn't lsof feature xxx enabled for OpenBSD?

Lsof's Configure script enables OpenBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See `00PORTING` for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree lsof is searching is incomplete or out of date.

Lsof normally looks for OpenBSD header files in `/usr/include` and `/sys`. It can also be directed to look in other directories if told to do so with the contents of the `LSOF_INCLUDE` and `NETBSD_SYS` environment variables.

To determine what header file enables a missing feature, check the OpenBSD stanza in the Configure script. Then check the locations it checks for the indicated header files and contents.

See `00XCONFIG` for more information on `LSOF_INCLUDE` and `NETBSD_SYS`.

## 14.0 Output Problems

### 14.1 Why do the lsof column sizes change?

Lsof dynamically sizes its output columns each time it runs to make sure that each column takes the minimum space. Column parsing -- e.g., with `awk` -- is possible, because each column is guaranteed to be separated from the preceding one by at least one space, and no column except the last (`NAME`) contains embedded

spaces.

#### 14.2 Why does the offset have ``0t' and ``0x" prefixes?

The offset value that appears in the SIZE/OFF column has ``0t' and ``0x" prefixes to distinguish it from size values that may appear in the same column.

Normally if the offset value is less than 100,000,000 (8 digits), it appears in decimal with a ``0t' prefix; over 99,999,999, in hexadecimal with a ``0x" prefix.

A decimal offset is handy, for example, when tracking the progress of an outbound ftp transfer. When lsof reports on the ftp process, it will report the size of the file being sent with its open descriptor; it will report the progress of the transfer via the offset of the outbound open ftp data socket descriptor.

The ``-o [n]" option may be used to specify the maximum number of decimal digits to be printed after ``0t" before lsof switches to the hexadecimal digits after ``0x". As already noted, the default decimal digit count is 8.

#### 14.3 What are the values printed in the FILE\_FLAG column and why is 0x<value> sometimes included?

The two comma separated lists, separated by a semicolon, printed in the FILE-FLAG column (when the "+fg" option is specified), are short-hand names or hexadecimal values for the bits lsof finds in the f\_flag or f\_flags member of file structures for files (the first list, the one before the semicolon), and process open files flags found in various kernel structures, often named "pofile" (the second list, the one after the semicolon).

Lsof determines the short-hand names from symbols in the <fcntl.h>, <linux/fs.h>, <sys/fcntl.h>, <sys/fcntlcom.h>, <sys/file.h>, and <sys/user.h> header files.

See the discussion of FILE-FLAG in the OUTPUT section of the lsof man page, and the FF\_\* and POF\_\* symbols in lsof.h for a list of the names.

Bits with no names defined for them are represented by an 0x<value> member of the comma-separated list -- a hexadecimal integer. When "+fG" is specified (instead of "+fg"), lsof

will list all  
flag values as two hexadecimal integers,  
separated by a semicolon.

When "-FG" is specified to get the flags in an output field,  
the format defaults to hexadecimal. You can get names  
instead by following "-FG" with "+fg" -- e.g.,

```
$ lsof -FG +fg ...
```

However, when you precede "-FG" with "+fg" -- e.g.,

```
$ lsof +fg -FG
```

the format will be hexadecimal; order is important.

#### 14.3.1 Why doesn't lsof display FILE\_FLAG values for my dialect?

All versions of lsof except the /proc-based Linux lsof  
report FILE-FLAG values. Lsof can't obtain FILE-FLAG  
information from the Linux /proc interface.

#### 14.4 Network Addresses

##### 14.4.1 Why does lsof's -n option cause IPv4 addresses, mapped to IPv6, to be displayed in IPv6 notation?

When you use the -n option to tell lsof to display numeric  
network addresses, and an IPv4 address has been mapped to  
IPv6, lsof displays the address in IPv6 format and puts  
"ipv4" in the TYPE column. That combination indicates the  
IPv4 address  
has been mapped to IPv6.

For example, the IPv4 address 1.2.3.4, when mapped to an  
IPv6 address, will be displayed by lsof as:

```
[::ffff:1.2.3.4]
```

The enclosing brackets are lsof's signal that this is an  
IPv6 address. Inside the brackets is a standard IPv6  
address, reported by inet\_ntop(). The first two colons,  
signifying zeroes in the first 64 bits of the IPv6 address,  
and the hexadecimal ffff in the next 32 bits, indicate that  
the last 32 bits contains a mapped IPv4 address, which is  
then displayed in IPv4 dot notation.

##### 14.5 Why does lsof output \x, ^x, or \xnn for characters

sometimes?

Lsof displays only printable ASCII characters. Lsof considers a character printable if `isprint(3)` says it is. If `isprint(3)` says a character isn't printable, the lsof man page explains:

"... Non-printable characters are printed in one of three forms: the C `\\[bfrnt]` form; the control character `^` form (e.g., `^@`); or hexadecimal leading `\\x` form (e.g., `\\xab`). Space is non-printable in the COMMAND column (`\\x20`) and printable elsewhere."

#### 14.5.1 Why is space considered a non-printable character in command names?

Space is considered an unprintable character in command names because it is sometimes possible to hide the full command name from scripts that parse `ps(1)` output by embedding a space in the name.

#### 14.6 Why doesn't lsof print all the characters of a command name?

By default lsof prints the first nine characters of the names of commands associated with processes. If more characters are required, the "w" value of the "+c w" option may be used to specify a larger width.

If "w" is zero (0) lsof will print all characters of all command names up to the limit of the number of characters supplied by the particular UNIX dialect. When reporting command names, lsof replaces non-printable characters as discussed in the answer to "Why does lsof output `\\x`, `^x`, or `\\xnn` for characters sometimes?"

See

the answer to the "Why is space considered a non-printable character in command names?" question for an explanation of why spaces are replaced by the `\\x20` representation in command names.

The number of command name characters supplied to lsof by UNIX dialects in files and structures varies by dialect. For example, Linux 2.4.27 supplies lsof the first 15 characters of command names and Solaris 9 supplies 16. Thus, even if "w" is zero (0), lsof can't report more characters for command names

on those two UNIX dialects than they provide lsof.

14.7 Why does lsof reject some -c command names, saying their lengths are "> what system provides (nn)"?

The command name length that a specific system provides varies from dialect to dialect. As noted in the answer to the "Why doesn't lsof print all the characters of a command name?" question, Linux and Solaris provide a limited number of command name characters.

When more characters are specified in the parameter to the -c option, lsof considers it an error and issues a fatal error message -- e.g.,

lsof: "-c xxxxyyyy" length (8) > what system provides (7)

The only work-around is to specify no more characters to -c than the system provides to lsof.

14.8 Why does lsof sometimes print TYPE numbers instead of names?

When lsof can't convert a type number to a name for printing in the TYPE column, it will report the number as four octets.

14.9 Marker line format problems

14.9.1 Why won't lsof accept a marker line format?

Lsof's Configure script must find the localtime(3) and strftime(3) functions in the dialect's C library in order to enable support for marker line formats.

Check the output of lsof's -v option for the presence of -DHAS\_STRFTIME in the compiler flags. If it isn't there, Configure didn't find the necessary two C library functions.

If you think lsof should have found the functions, make a copy of the C test program in the Configure script that it uses to find the functions. Then use the copy, or a more informative modification of it, to learn why Configure can't find the functions. You can find that program by searching for strftime.

14.9.2 Why does lsof reject the NL (%n) marker line format?

When repeat mode and field output (with -F) have both been specified, lsof won't allow new line (NL) formats to be specified with ``%n". That's because the marker line is always guaranteed to be a single line.

There is no work-around to this restriction.

#### 14.10 How are protocol state name exclusion and inclusion used?

Protocol state name inclusion and exclusion with the ``-s p:s" option and its arguments have some issues to consider.

First, there is the problem of determining what state names, if any, the dialect produces. Try running this lsof command to find them:

```
$ lsof -i
```

Knowing the state names of interest, the next problem is to decide on the lsof options and their parameters that will produce the desired output.

Here some examples are probably the most useful.

To list only TCP socket files in LISTEN and CLOSE\_WAIT states, use:

```
$ lsof -itcp -stcp:listen,close_wait
or
$ lsof -iTCP -sTCP:LISTEN,CLOSE_WAIT
```

Case isn't important to lsof in protocol and state names.

To exclude TCP socket files in CLOSE\_WAIT state, use:

```
$ lsof -itcp -stcp:^close_wait
```

Note the `^' preceding close\_wait; it selects exclusion. You can mix included and excluded names in a comma separated list, but you may not include and exclude the same name for the same protocol.

To list TCP files in LISTEN state and UDP files in Idle state, use:

```
$ lsof -i -stcp:listen -sudp:idle
```

Note: if you don't accompany the ``-s p:s" list option and

arguments with the -i option, lsof will list all other regular files, while applying the specified inclusion and exclusion specifications to network files. Generally, then, you want to use -i with -s.

#### 14.10.1 Why doesn't my dialect support state name exclusion and inclusion?

When state name inclusion and exclusion was added, I had access to test systems for AIX, Darwin, FreeBSD, Linux, PSTAT-based HP-UX and Solaris.

Therefore, I was unable to add and test the support to any other UNIX dialects.

If a dialect has the support, then the HASTCPUDPSTATE definition in its machine.h header file will be active; if not, it will be absent or commented out.

If your dialect doesn't have the support and you want it added, you will have to provide me Internet access to a test host, where I can compile lsof and have the credentials to test the changes the support requires. If that's possible for you, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 15.0 Pyramid Version Problems

#### 15.0.5 Statement of deprecation

As of lsof revision 4.52 support for all Pyramid versions has been dropped. Contact me via e-mail at <abe@purdue.edu> if you are interested in obtaining the last lsof Pyramid distribution. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 16.0 SCO Problems

#### 16.1 SCO OpenServer Problems

##### 16.1.1 How can I avoid segmentation faults when compiling lsof?

If you have an older SCO OpenServer compiler, it may get a segmentation fault when compiling some lsof modules.



That appears to happen because of the -Ox optimization action requested in the lsof Makefile.

Try changing -Ox to -O with this make invocation:

```
$ make DEBUG=-O
```

Bela Lubkin supplied this tip and Steve Williams verified it.

#### 16.1.2 Where is libsocket.a?

If you compile lsof and the loader says it can't find the socket library, libsocket.a, called by the -lsocket option in the lsof compile flags, you probably are running an SCO OpenServer release earlier than 5.0 and don't have the TCP/IP Development System package installed.

You may have the necessary header files, because you have the TCP/IP run-time package installed, but if you don't have the TCP/IP Development System package installed, you won't have libsocket.a.

Your choices are to install the TCP/IP Development System package or upgrade to OpenServer Release 5.0. You will find libsocket.a in 5.0 -- you'll find all the libraries and header files there, in fact -- and you can use gcc to compile lsof if you don't want to install the 5.0 Development System package.

#### 16.1.3 Why do I get "warning C4200" messages when I compile lsof?

When you compile lsof under OSR 3.2v4.2 (and perhaps under earlier versions as well), you may get many compiler warning messages of the form:

```
node.c(183) : warning C4200: previous declarator is not compatible with default argument promotion
```

In my opinion this is a bug in the OSR compiler. Because the compiler cannot handle full ANSI-C prototypes, it assumes default types for function parameters as it encounters untyped in a function prototype -- e.g., in this function declaration from node.c,

```
readrnode(ra, r)
```

```
KA_T ra;
struct rnode *r;
{
...
```

the compiler assigns default int types to the ra and r arguments.

Then, when the compiler encounters the fully typed parameters after the function skeleton and sees parameters with types that don't match the assumptions it previously made, it whines about its own assumptions.

You can ignore these messages.

## 16.2 SCO|Caldera UnixWare Problems

### 16.2.1 Why doesn't lsof compile on my UnixWare 7.1.1 or above system?

When you Configure lsof with the "uw" abbreviation and try to compile it for UnixWare 7.1.1, you may get compiler error messages like this:

```
UX:acomp: ERROR: "dproc.c", line 98:
undefined struct/union member: p_pgidp
```

This suggests that you probably have a non-stop cluster UnixWare 7.1.1 system. Its <sys/proc.h> header file differs from the one on the system where I did the lsof port to UnixWare 7.1.1. I currently don't have access to a non-stop cluster system to be able to develop changes to lsof that would make it compile and work there.

If you have a non-stop cluster UnixWare 7.1.1 system, want lsof for it, and can offer me a test account on the system, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

If you have a system with nsc\_cfs and can offer me a test account on it, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 16.2.2 Why does lsof complain about node\_self() on my UnixWare 7.1.1 or above system?

If lsof exits immediately after issuing this message:

```
can't identify process NSC node; node_self(): <message>
```

It means that lsof has been built to run on a NonStop Cluster (NSC) UnixWare 7.1.1 or higher system and can't get the number of the node on which it is running. Lsof uses the node number to determine the path to the kernel boot file.

You can tell if lsof has been built for NSC by looking for "-DHAS\_UW\_NSC" in lsof's "-v" option output.

If the system on which you're trying to run lsof isn't running an NSC kernel, you will need to build a non-NSC lsof.

16.2.3 Why does UnixWare 7.1.1 or above complain about -lcluster, node\_self(), or libcluster.so?

When you build, compile, and load lsof for UnixWare 7.1.1 and above, ld may complain that it can't find the -lcluster library or that the node\_self symbol is undefined. When you try to run an existing lsof binary it may complain that libcluster.so can't be found.

These messages mean the tests made by Configure on your system led it to believe your system is running a NonStop Cluster (NSC) kernel, or the lsof binary you're trying to use was built on a NonStop Cluster system. If an lsof binary was built for NSC, this shell command produces output:

```
$ strings
<lsof_binary> | grep HAS_UW_NSC
```

If that's not the case, and you can rebuild lsof, set the UW\_HAS\_NSC environment variable to "N" and do this:

```
$ Configure -n clean
$ UW_HAS_NSC=N
$ export UW_HAS_NSC
$ Configure -n uw
$ make
```

You can also edit Makefile and lib/Makefile. Remove

-DHAS\_UW\_NSC from the CFGF strings. Remove -lcluster from the CFGL strings. Then run make again.

If you have an existing NSC lsof binary and you want one for a non-NSC system, you will have to build lsof yourself on the system where you want to use it. (That's always a good idea anyway.)

16.2.4 Why does UnixWare 7.1.1 or above lsof complain it can't read the kernel name list?

If lsof complains:

```
can't read kernel name list from <path>
```

It means that lsof can't find the booted kernel image file at <path>. On NonStop Cluster (NSC) UnixWare 7.1.1 or higher systems lsof determines the booted file path by examining this file:

```
/stand/node_self/boot
```

If examining that file doesn't lead to an NSC path, lsof uses:

```
/stand/1/unix
```

On non-NSC systems lsof expects the booted kernel image to be in /stand/unix.

If your booted kernel image is in a different place, use lsof's "-k <path>" option to specify its path.

16.2.5 Why doesn't lsof report link count, node number, and size for some UnixWare 7.1.1 or above CFS files?

Lsof reports link count, node number, and size for open CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the node where lsof runs, so lsof cannot report them.

16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?

Lsof can only report on files open on the node on which it runs, because the information lsof reports comes from the

private kernel memory of the node. This may mean that asking lsof to find a specific open file, or use of a specific Internet address or port, may not report all open instances on nodes other than the one used to run lsof.

You can use the NSC `onnode(1)` command to run lsof on specific nodes, or the `onall(1)` command to run lsof on all nodes -- e.g.,

```
$ onall lsof [options] 2>&1 | less
```

or

```
$ onnode node-number lsof [options] 2>&1 | less
```

Note that, when lsof is run all nodes, the path name component assembly results it reports in its NAME column may vary, because the dynamic name cache from which lsof gets the components is private to the kernel of each node.

Also note the use of shell redirection in the examples to merge the standard error file information from `onnode` and `onall` with lsof's standard output file output. That will put the `onnode` and `onall` node announcements in proper sequence with lsof's output.

#### 16.2.7 Why doesn't lsof report the UnixWare 7.1.1 NonStop Cluster (NSC) node a process is using?

To induce lsof to report the node on which a process runs would be a significant, non-standard modification to lsof.

It

has much wider implications than merely the printing of a number in an output column. I'm not currently (April 2001) prepared to undertake such a modification.

If you want node-specific NSC information about open files, run lsof under the control of `onall(1)` or `onnode(1)`.

```
$ onall lsof [options] 2>&1 | less
```

or

```
$ onnode node-number lsof [options] 2>&1 | less
```

#### 16.2.8 Why does the compiler complain about missing UnixWare 2.1[.x] header files?

SCO|Caldera didn't ship the following header files with UnixWare 2.1 through 2.1.3:

<fs/proc/prdata.h>  
<fs/procfs/prdata.h>  
<sys/fs/fifonode.h>  
<sys/fs/namenode.h>

Lsof needs those header files for its compilation. Contact SCO|Caldera to get copies of those header files.

If you can't get the header files from SCO|Caldera, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 17.0 Sun Problems

### 17.0.5 Statement of deprecation

Lsof support for SunOS 4.1.x was last tested at revision 4.51. Contact me via e-mail at <abe@purdue.edu> if you're interested in obtaining it. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 17.1 My Sun gcc-compiled lsof doesn't work -- why?

Gcc can be used to build lsof successfully. However, an improperly installed Sun gcc compiler will usually not produce a working lsof.

If your Sun gcc-compiled lsof doesn't report anything, or reports "can't read proc table," or gcc refuses to compile lsof without error, check that the gcc step that "fixes" Sun header files was run on the system where you're using gcc to compile lsof. As an alternative, if you have the SunPro C 5.0 compiler or later available, use it to compile lsof -- e.g., use the solariscc Configure abbreviations.

### 17.2 How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Presuming your gcc-specific header files are wrong for Solaris, edit the lsof Configure-generated Makefile and lib/Makefile and make this change:

CFGF= -Dsolaris=20400 ...  
to

```
CFGF= -Dsolaris=20400 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF= -Dsolaris=20500 ...
```

to

```
CFGF= -Dsolaris=20500 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF= -Dsolaris=20501 ...
```

to

```
CFGF= -Dsolaris=20501 -D__STDC__=0 -I/usr/include ...
```

This is only a temporary work-around. You really should instruct gcc to update your gcc-specific header files or install a recent gcc (e.g., 3.2), which has no need for private copies of Solaris include files.

### 17.3 Why does Solaris Sun C complain about system header files?

You're probably trying to use `/usr/ucb/cc` if you get compiler complaints like:

```
cc -O -Dsun -Dsolaris=20300 ...
"/usr/include/sys/machsig.h", line 81: macro BUS_OBJERR
redefines previous macro at "/usr/ucbinclude/sys/signal.h",
line 444
```

Note the reference to `"/usr/ucbinclude/sys/signal.h"`.

It

reveals that the BSD Compatibility Package C compiler is in use. Lsof requires the ANSI C version of the Solaris C compiler, usually found in `/usr/opt/bin/cc` or `/opt/SUNWspro/bin/cc`.

Try adding a `CC` string to the lsof Makefile that points to the Sun ANSI C version of the Sun C compiler -- e.g.,

```
CC= /usr/opt/bin/cc
```

or

```
CC= /opt/SUNWspro/bin/cc.
```

### 17.4 Why doesn't lsof work under my Solaris 2.4 system?

If lsof doesn't work under your Solaris 2.4 system -- e.g., it produces no output, little output, or the output is missing command names or file descriptors -- you may have

a pair of conflicting Sun patches installed.

Solaris patch 101945-32 installs a kernel that was built with a <sys/auxv.h> header file whose NUM\_\*\_VECTORS definitions don't match the ones in the <sys/auxv.h> updated by Solaris patch 102303-02.

NUM\_\*\_VECTORS in the kernel of patch 101945-32 are smaller than the ones in the <sys/auxv.h> of patch 102303-02.

The consequence is that when lsof is compiled with the <sys/auxv.h> whose NUM\_\*\_VECTORS definitions are larger than the ones used to compile the patched kernel, lsof's user structure does not align with the one that the kernel employs.

If you have these two patches installed, contact Sun and complain about the mis-match.

You may be able to work around the problem by editing /usr/include/sys/auxv.h to have the following NUM\_\*\_VECTORS definitions:

```
#define NUM_GEN_VECTORS 4
#define NUM_SUN_VECTORS 8
```

The Configure script issues a prominent WARNING that you should try the work-around.

I thank Leif Hedstrom for identifying the offending patches.

#### 17.5 Where are the Solaris header files?

If you try to compile lsof under Solaris and get a compiler complaint that it can't find system header files, perhaps you forgot to add the header file package, SUNWhea.

#### 17.6 Where is the Solaris /usr/src/uts/<architecture>/sys/machparam.h?

When you try to Configure lsof for Solaris 2.[23456], 2.5.1, and 7 -- e.g., on a `uname -m` == sun4m system -- Configure complains:

```
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
```



And when you try to compile the configured lsof, cc or gcc complains:

```
dproc.c:530: `KERNELBASE' undeclared (first use this function)
```

The explanation is that somehow your Solaris system doesn't have the header files in /usr/src/uts it should have. Perhaps someone removed the directory to save space. Perhaps you're using a gcc installation, copied from another system. In any event, you will have to load the header files from the SUNWhea package of your Solaris distribution.

KERNELBASE is an important symbol to lsof -- it keeps lsof from sending an illegal kernel value to kvm\_read() where a segmentation violation might result (a bug in the kvm library). Lsof can get illegal kernel values because it reads kernel values slowly with kvm\_read() calls that the kernel is changing rapidly.

Lsof doesn't need KERNELBASE at Solaris 2.5 and above, because it has a KERNELBASE value whose address lsof can find with /dev/ksyms and whose value it can read with kvm\_read(). Under Solaris 2.5 /usr/src/uts has moved to /usr/platform.

#### 17.7 Why does Solaris lsof say "can't read proc table"?

When lsof collects data on processes, using the kvm\_\*() functions to scan the kernel's proc structure table, it checks to make sure it has identified a reasonable number of them -- a minimum of three. When lsof can't identify three processes during a scan, it repeats the scan.

When five scans fail to yield three processes, lsof issues the fatal message:

```
lsof: can't read proc table
```

and exits.

Usually lsof fails to identify three processes during a scan because its idea of the form of the proc structure differs from that being used by the kernel. Since the proc structure is defined in <sys/proc.h> and other /usr/include header files, the root cause of a proc structure discrepancy usually can be found in the composition of /usr/include.

One common way that /usr/include header files can be incorrect is that gcc was used to compile lsof, gcc used its special (i.e., "fixed") header files instead of the ones in /usr/include, and the special gcc header files weren't updated when Solaris was. Answers to these questions:

My Sun gcc-compiled lsof doesn't work -- why?

How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Why does Solaris Sun C complain about system header files?

discuss the gcc header file problem and offer suggestions on how to fix it or work around it.

It may also be that you are trying to run a version of lsof that was compiled on an older version of Solaris. For example, an lsof executable, compiled for Solaris 2.4, will produce the "can't read proc table" message if you try to run it under Solaris 2.5.

If you have compiled lsof under Solaris 2.5 and it still won't work, see if the header files in /usr/include have been updated to 2.5, or still represent a previous version of Solaris.

Another source of header file discrepancies to consider is the Solaris patch level and whether a binary kernel patch was not matched with a corresponding header file update. See the "Why doesn't lsof work under my Solaris 2.4 system?" question for an example of one in Solaris 2.4 -- there may be other such patch conflicts I don't know about.

#### 17.8 Why does Solaris lsof complain about a bad cached clone device?

When lsof revisions below 4.04 have been run on a Solaris system and have been allowed to create a device cache file, the running of revisions 4.04 and above on the same systems may produce this complaint:

```
lsof: bad cached clone device: ...
```

```
lsof: WARNING: created device cache file: ...
```

This is the result of a change in the device cache file that took place at lsof revision 4.04. The change introduced a node number into the clone device lines of the device

cache file and was done in such a way that lsof could detect device cache files whose clone lines don't have node numbers (lines created by previous lsof revisions) and recognize the need to regenerate the device cache file.

#### 17.9 Why doesn't Solaris make generate .o files?

Solaris /usr/ccs/bin/make won't generate .o files from .c files if /usr/share/lib/make/make.rules is missing. It may be found in and installed from the SUNWsport package.

#### 17.10 Why does lsof report some Solaris 2.3 and 2.4 lock types as `N`?

For Solaris 2.3 with patch P101318 installed at level 45 or above, and for all versions of Solaris 2.4, NFS locks are represented by a NFS-specific kernel lock structure that sometimes lacks a read or write lock type indicator. When lsof encounters such a lock structure, it reports the lock type as `N`.

#### 17.11 Why does lsof Configure say "WARNING: no cc in ..."?

When lsof's Configure script is executed with the solariscc abbreviation it tries to make sure it's using the Sun C compiler and not the UCB substitute from /usr/ucb/cc. Thus, it looks for cc in the "standard" Sun compiler location, /opt/SUNWspro/bin.

If Configure can't find cc there, it issues the warning:

```
lsof: WARNING: no cc in /opt/SUNWspro/bin;
using cc without path.
```

and uses cc for the compiler name, letting the shell find cc with its PATH environment variable.

You can tell Configure where to find your cc with the SOLARIS\_CCDIR cross-configuration environment variable. (See 00XCONFIG for more information on SOLARIS\_CCDIR). For example, use this Configure shell command:

```
SOLARIS_CCDIR=/usr/special/bin Configure -n solariscc
```

(SOLARIS\_CCDIR should be the full path to the directory containing your cc.)

#### 17.12 Solaris 7, 8 and 9 Problems

### 17.12.1 Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?

Solaris 7, 8 and 9 kernels come in two flavors, 32 and 64 bit. 64 bit kernels run on machines that support the SPARC v9 instruction set architecture. Separate executables for some programs, -- e.g., ones using libkvm like lsof -- must be built for 32 and 64 bit kernels.

Previous Sun (e.g., SC4.0) and earlier gcc compilers will build lsof for 32 bit kernels, but they won't build it for 64 bit kernels. Compilers that will build lsof for 64 bit Solaris 7, 8 and 9 kernels are the Sun WorkShop Compilers C 5.0 and above, and recent gcc versions, e.g., 3.2.

When given the `--xarch=v9` flag, the C 5.0 compiler and above, and associated loader and 64 bit libraries will build a 64 bit lsof executable; when given the `-m64` or `-mcpu=v9` (deprecated) flags, an appropriate gcc compiler will build a 64 bit lsof executable.

When the lsof Configure script detects a 64 bit kernel is in use (e.g., by executing `~/bin/isainfo -kv``), and when it finds that the specified compiler is inappropriate, it complains with these messages:

For gcc:

```
!!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!!
"!
"!
"! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT !"
"! THIS GCC DOESN'T SUPPORT THE BUILDING OF 64 BIT !"
"! SOLARIS EXECUTABLES. LSOF WILL BE CONFIGURED FOR A !"
"! 32 BIT echo KERNEL. !"
"!
"!
!!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!!
```

For Sun C:

```
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!
!
!
! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT |
! THE VERSION OF SUN C AVAILABLE DOESN'T SUPPORT THE !
! -xarch=v9 FLAG. LSOF WILL BE CONFIGURED FOR A 32 BIT !
! KERNEL. !
```

!

!

!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!

17.12.2 Why does Solaris 7, 8 or 9 lsof say "FATAL: lsof was compiled for..."?

Solaris 7, 8 or 9 lsof may say:

lsof: FATAL: lsof was compiled for a xx bit kernel,  
but this machine has booted a yy bit kernel.

Where: xx = 32 or 64  
yy = 64 or 32

(xx and yy won't match.)

This message indicates that lsof was compiled for one size kernel and is being asked to execute on a different size one. That's not possible for programs like lsof that use libkvm.

Depending on the instruction sets for which you need Solaris 7, 8 or 9 lsof, you may need two or more versions of lsof, compiled for each kernel size, installed for use with /usr/lib/isaexec. See the "How do I install lsof for Solaris 7, 8 or 9?" section of this document for more information on that.

17.12.3 How do I build lsof for a 64 bit Solaris kernel under a 32 bit Solaris kernel?

If your Solaris system has an appropriate compiler (e.g., WorkShop Compilers C 5.0 and above, or a recent gcc like 3.2) and the 64 bit libraries have been installed, you can force lsof's Configure script to build a 64 bit version of lsof with:

```
$ SOLARIS_KERNBITS=64 Configure -n solariscc
```

The SOLARIS\_KERNBITS environment variable is part of the lsof cross-configuration support, described in the 00XCONFIG file of the lsof distribution.

17.12.4 How do I install lsof for Solaris 7, 8 or 9?

If you are installing lsof where it will be used only under

the bit size kernel for which it was built, no special installation is required.

If, however, you are installing different versions of lsof for different bit sizes -- e.g., for use on a 64 bit NFS server and from its 32 bit clients -- you should read the man page for isaexec(3C) and install lsof according to its instructions.

The executable at the directory where lsof is to be found should be a hard link to /usr/lib/isaexec or a copy of it.

In the directory there must be instruction architecture subdirectories -- e.g., .../sparc/ and .../sparcv9/. The lsof for 64 bit size kernels is installed in the .../sparcv9/ subdirectory; the one for 32 bit size kernels, in .../sparc/.

For example, if you're installing 32 and 64 bit lsof executables in /usr/local/etc, you would:

```
cd /usr/local/etc
ln /usr/lib/isaexec lsof
mkdir sparc sparcv9
install the 32 bit lsof as sparc/lsof
install the 64 bit lsof as sparcv9/lsof
chmod, chown, and chgrp sparc/lsof and
 sparcv9/lsof appropriately
```

Lsof permissions and ownerships are the same whether one or more lsof executables are being installed, with or without the /usr/lib/isaexec hard link.

17.12.5 Why does my Solaris 7, 8 or 9 system say it cannot execute lsof?

When you attempt to execute lsof, your Solaris 7, 8 or 9 shell may complain:

```
ksh: ./lsof: cannot execute
```

If the lsof executable exists and has the proper execution permissions, this error may be the result of trying to execute an lsof, built for a 64 bit kernel, on a 32 bit kernel.

This will tell you about the lsof executable:

```
$ file lsof
```

```
lsof: ELF 64-bit MSB executable SPARCV9 Version 1,
dynamically linked, not stripped
```

The "64-bit" notation indicates the binary was built for a 64 bit kernel. To see the running kernel bit size, use this command:

```
$ isainfo -kv
```

```
32-bit sparc kernel modules
```

The "32-bit" notation indicates a 32 bit kernel has been booted.

The only work-around is to obtain, or Configure and make, an lsof for the appropriate kernel bit size. If you Configure and make lsof on the kernel where you wish to run it the proper compiler, the lsof Configure step will generate Makefiles that can be used with make to build an appropriate lsof executable.

To compile a 64 bit lsof, you must have an appropriate compiler -- i.e., Sun WorkShop Compilers C 5.0 or higher or a recent gcc like 3.2.

17.12.6 What gcc will produce 64 bit Solaris  
7, 8 and 9 executables?  
8 and 9 executables?

Properly built and installed recent gcc versions -- e.g.,  
3.2 -- will build lsof for 64 bit Solaris kernels.

If you update your gcc version to 3.2 or later, make sure the private gcc header files become current -- i.e., clear out any private header files from a previous gcc or Solaris installation before installing the new ones, or build to a new --prefix root and replace the old root with it after the build and installation are complete.

17.12.7 Why does lsof on my Solaris 7, 8 or 9 system say, "can't read namelist from /dev/ksyms?"

You're probably trying to use an lsof executable built for an earlier Solaris release on a 64 bit Solaris 7, 8 or 9 kernel. The output from `lsof -v` will tell you the build environment of your lsof executable. You should also have gotten a warning message that lsof is compiled for a different Solaris version than the one under which it is

running -- something like this:

```
lsof: WARNING:
compiled for Solaris release X; this is Y
```

You need to build lsof on the system where you want to use it. For 64 bit Solaris 7, 8 and 9 you need a compiler that can generate 64 bit Solaris executables -- e.g., the Sun Workshop 5 C compiler or later, or a recent gcc version like 3.2. See the "Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?" section and the ones following it for a discussion of building lsof for 64 bit Solaris 7, 8 or 9.

### 17.13 Solaris and COMMON

#### 17.13.1 What does COMMON mean in the NAME column for a Solaris VCHR file?

When lsof puts COMMON or (COMMON) in the NAME column of a Solaris VCHR file, it means that the file is handled by the special file system functions of the kernel through a common vnode.

#### 17.13.2 Why does a COMMON Solaris VCHR file sometimes seem to have an incorrect minor device number?

When lsof reports on an open file in a Solaris special file system that uses a COMMON vnode, and the file is a VCHR file, lsof tries to locate the associated device node by looking for matches on the major and minor device numbers first.

If no major and minor match results, lsof then looks for a match on pseudo and clone device files. (See /devices/pseudo.) Those device nodes are matched specially by either their major or minor device numbers, but not both. Hence, when lsof finds a match under those special conditions, it may report a value in its output DEVICE column that differs from one of the major and minor numbers of the device node.

Here's an example from a sun4m Solaris 7 system:

```
$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root sys 117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
COMMAND ... DEVICE ... NODE NAME
```



```
powerd 117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
```

Note that the DEVICE value for the file with (COMMON) in its name field has a different minor device number (1) from what ls reports (0), while the DEVICE value for the file without (COMMON) matches the ls output exactly. Both match on the major device number, 117. The minor device number mis-match is a result of the way the Solaris kernel handles special file system common vnodes, and it's the reason lsof puts (COMMON) after the name to signal that a mis-match is possible.

#### 17.14 Why don't lsof and Solaris pfiles reports always match?

/usr/proc/bin/pfiles for Solaris 2.6, 7, 8, and 9 also reports information on open files for processes. Sometimes the information it reports differs from what lsof reports.

There are several reasons why this might be true. First, because pfiles is a Sun product, based on Sun kernel features, its developers have a better chance of knowing exactly how open file information is organized. I sometimes have to guess at how kernel file structure linkages are constructed by gleaning hints from header files.

Second, lsof is aimed at providing information, specifically device and node numbers, that can be used to identify named file system objects -- i.e., path names. Thus, lsof tries to make sure its device and node numbers match those reported by stat(2). Pfiles doesn't always report numbers that match stat(2) -- e.g., for files using clone and pseudo devices via common vnodes like the nlist() /dev/ksyms usage.

Here's the Solaris 7 COMMON VCHR example again with additional pfiles output:

```
$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root sys 117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
vic1: 10 = lsof /dev/pm
COMMAND ... DEVICE ... NODE NAME
powerd ... 117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
$ pfiles ...
0: S_IFCHR ... dev:32,24 ino:61945 ... rdev:117,1
```

...

14: S\_IFCHR ... dev:32,24 ino:151261 ... rdev:117,0

Note that the NODE number, reported by lsof, matches what ls(1) and stat(2) report, while the ino value pfiles reports doesn't. Lsof also indicates with the (COMMON) notation that the DEVICE number is a pseudo one, derived from the character device's value. The lsof DEVICE value matches the pfiles rdev value, correct behavior for a character device, but pfiles gives no sign that it's not possible to find that character device number in /devices with ls(1) or stat(2).

17.15 Why does lsof say, "kvm\_open(namelist=default, core=default): Permission denied?"

Lsof needs permission to read from the /dev/kmem and /dev/mem memory devices. Access to them is opened via a call to the kvm\_open() library function and it reports the indicated message.

You must give lsof permission to read the memory devices. The super user can almost always do that, but other lsof users can do it if some group -- e.g., sys -- has permission to read the memory devices, and the lsof binary is installed with the group's ownership and with the setgid permission bit enabled.

17.16 Why is lsof slow on my busy Solaris UFS file system?

Lsof may be slow on a busy Solaris UFS file system when UFS logging has been enabled with the "logging" mount option. That option can significantly increase disk operations under certain conditions -- e.g., when a lot of files are accessed quickly.

When only the "logging" option is specified to mount, all file accesses (atime updates) are logged to the UFS logging queue. Each atime update requires two writes to the disk to complete it.

If you want to do UFS logging -- and there are reliability advantages to it -- consider using the "logging,noatime" mount options instead. That will shift atime updates from the logging queue to fewer and independent asynchronous operations, consequently making the UFS logging queue a

smaller bottleneck.

Consult mount\_ufs(1M) for more information on the logging and noatime options.

(My thanks to Casper Dik for this tip on improving the performance of UFS logging.)

#### 17.17 Why

is lsof so slow on my Solaris 8 or 9 system?

Solaris 8 has a post-release feature upgrade modifying kernel name cache (DNLC) handling that can slow lsof throughput dramatically. The feature, sometimes called negative DNLC caching, is standard in Solaris 9.

As best I can tell, when you install the Solaris 8 MU1 package, you get negative DNLC caching. If this pipe produces any output, your system has negative DNLC caching.

```
$ nm /dev/ksyms | grep negative_cache_vnode
```

The reason negative DNLC caching perturbs lsof is that a single vnode address (found in the negative\_cache\_vnode kernel variable) is used to mark entries in the DNLC that are not (the negative part) found on disk.

Since a single vnode address (the DNLC key lsof uses) can represent many (I've seen upwards of 30,000.) DNLC entries, their presence overloads lsof's internal DNLC hashing function. An overloaded hash function is a slow hash function, and lsof's slows to a crawl when it encounters thousands of keys that produce the same value when the lsof DNLC hash function is applied to them.

The solution is simple -- ignore negative DNLC cache keys. They don't represent path name components lsof can use. Lsof revisions 4.50 and above have an addition that ignores them and the performance of those lsof revisions improves significantly when presented with negative DNLC cache keys.

If you don't have an lsof revision at 4.51 or later, there's a work-around. Use lsof's ``-C'' option. It disables lsof's DNLC caching. Of course, that also inhibits the reporting of any path name components from the kernel DNLC. When ``-c'' is used, lsof will continue to report file system and character device paths.

## 17.18 Solaris and VxFS

### 17.18.1 Why doesn't lsof support VxFS 3.4 on Solaris 2.6, and above?

Lsof will not support VxFS version 3.4 on Solaris 2.6 and above unless some files from VxFS Update 2 have been installed. VxFS 3.4 FCS and VxFS 3.4 update 1 lack the header files lsof normally uses to obtain information from the VxFS 3.4 kernel node structure, vx\_inode. VxFS 3.4 Update 2 provides a method whereby lsof can obtain the necessary vx\_inode information from the vxfsu\_get\_ioffsets() function in Veritas utility libraries.

The utility libraries (32 bit and 64 bit versions) may be found in /opt/VRTSvxfs/lib. An ancillary header file may be found in /opt/VRTSvxfs/include/sys/fs/vx\_libutil.h. Documentation of the vxfsu\_get\_ioffsets(3) function may be found in /opt/VRTS/man/man3/vxfsu\_get\_ioffsets.3.

Those files of VxFS 3.4 Update 2 may be downloaded from:

```
ftp://ftp.veritas.com/pub/support/vxfs_34.i64243.tar
```

The vxfs\_34.i64243.tar archive will unpack into an i64243 directory containing these files:

```
$ ls i64243
README
libvxfsutil.sol26.sums
libvxfsutil.sol26.tar.Z
libvxfsutil.sol27.sums
libvxfsutil.sol27.tar.Z
libvxfsutil.sol28.sums
libvxfsutil.sol28.tar.Z
```

Read README. Select the \*.tar.Z file appropriate for your Solaris version. Its contents will unpack into /opt/VRTS and /opt/VRTSvxfs, so you will need sufficient permission -- e.g., do it as root -- to unpack the uncompressed archive. Once you've done that, it's a good idea to compare the checksums of the archive you unpacked with the ones recorded in the appropriate \*.sums file. Use `sum -r` to verify the checksums.

For example, if you want the Solaris 8 version, uncompress

and unpack libvxfstutil.sol28.tar.Z -- e.g.,

```
$ su
...
cd i6423
zcat libvxfstutil.sol28.tar.Z | tar xf -
```

That should create these new files and subdirectories with the indicated checksums:

```
File or subdirectory sum -r

/opt/VRTSvxfs/include/vxfstutil.h 03938
/opt/VRTSvxfs/lib/libvxfstutil.a 51794
/opt/VRTSvxfs/lib/sparcv9/
/opt/VRTSvxfs/lib/sparcv9/libvxfstutil.a 07420
/opt/VRTS/man/man3/
/opt/VRTS/man/man3/vxfsu_get_ioffsets.3 62480
```

Once these files are in place, run lsof's Configure script for the solaris or solariscc abbreviation. Configure will locate the appropriate VxFS 3.4 Update 2 files and set up for the making of an lsof that will properly display open VxFS 3.4 file information.

17.18.2 Why does lsof report "vx\_inode: vxfsu\_get\_ioffsets error" for open Solaris 2.6 and above VxFS 3.4 and above files?

Even when lsof supports VxFS 3.4 and above on Solaris 2.6 and above, it may report "vx\_inode: vxfsu\_get\_ioffsets error" in the NAME column for all VxFS files.

The usual cause is that lsof doesn't have permission to read the file at the end of the /dev/vxportal symbolic link. If, for example, lsof has been installed setgid(sys), then the /dev/vxportal symbolic link destination should be owned by the sys group and readable by it.

Update 2 for VxFS 3.4 sets the modes of the /dev/vxportal symbolic link destination to 0640 and the group ownership to sys. But I have had a report that the modes are wrong in a VxFS 4.0 installation.

Another cause may be that the system has more than one version of VxFS installed (Only one can be active.), and lsof's Configure script did not choose the header files and libraries

for the active VxFS version. Configure opts for VxFS 4.0 and above header files and libraries (in /opt/VRTS) in preference to those for VxFS below 4.0 (in /opt/VRTSvxfs).

Look for the directories /opt/VRTS and /opt/VRTSvxfs. If you have /opt/VRTS, make sure its header and library symbolic links point to those of the active VxFS version.

If you have both directories, look at the CFLAGS that Configure constructed for making lsof and see which directory path follows a -I option. If that doesn't match the directory path of the active VxFS version, try pointing Configure at the correct directory with the SOLARIS\_VXFSINCL environment variable -- e.g.,

```
$ SOLARIS_VXFSINCL=/opt/.../include ./Configure -n solaris
```

### 17.18.3 Why does Solaris Configure claim there is no VxFS library?

The lsof Configure script, when configuring for Solaris, may report:

```
FATAL: no VxFS .../libvxfsutil.a
```

That fatal error message indicates lsof has found the VxFS utility library's header files, but can't find the library itself in the expected location adjacent to the header files.

One possible cause is an incorrect symbolic link from /opt/VRTS/lib/sparcv9/libvxfsutil.a to the library's real location. (Some VxFS distributions declared the link incorrectly.) Use `ls -lL` on that path to see if it exists. If it doesn't exist, the link may be missing an additional leading "../" component.

If the problem is a missing "../" from the library's link, you can correct the link or check with Veritas/Symantec for the patch that corrects it.

If the problem is not a missing "../", and you know the libvxfsutil.a location, you can define its path in the SOLARIS\_VXFSLIB environment variable before running the lsof Configure script. (See 00XCONFIG for information about using the SOLARIS\_VXFSLIB environment variable.)

If you have no libvxfsutil.a, you must obtain it from

Veritas/Symantec or find it in your VxFS installation package.

#### 17.18.4 Why doesn't Solaris lsof report VxFS path name components?

Solaris lsof will report path name components for VxFS versions that use the common Solaris Dynamic Name Lookup Cache (DNLC) or on some file systems of VxFS versions that support the VxFS Reverse Name Lookup (RNL) facility.

VxFS versions 3.3 (approximately) and below use the common Solaris DNLC. (I haven't been able to determine exactly when VxFS stopped using the DNLC.) For versions above that boundary, but below 4.0, lsof can't report path name components.

At VxFS 4.0 and above, lsof can be compiled to use the VxFS RNL facility for reporting path names. If "-DHASVXFSRNL" appears in the compiler flags section of lsof "-v" option output, then the lsof Configure script detected the VxFS RNL facility and lsof has been compiled to use it.

Lsof's use of the RNL facility can fail when the VxFS file system disk layout version is below 6. In that case, lsof can report no path name components. For more information, see the `vxfs_inotopath(3)` manual page. any of the following commands will show the disk layout version for a VxFS file system, when supplied the block device or mount point on which the file system is mounted.

```
fstyp -v <block_device>
or
mkfs -m <block_device>
or
vxupgrade <mount_point>
```

You must have permission to read the block device -- e.g., be the root user.

You may also be able to upgrade an older disk layout to one that will work with the RNL. See the `vxupgrade(1M)` man page for more information on that.

When lsof can't report VxFS path name components, it reports the file system mount point and the path name of device on which it is mounted. The device path name is enclosed in parentheses.

#### 17.18.5 Why does Solaris 10 lsof report scrambled VxFS paths?

Solaris

10 lsof may report a bogus, scrambled path for an open VxFS file, when lsof obtains the path from a vnode's cached path. Veritas/Symantec reports that their Solaris 10 implementation has bugs in the way it handles the Solaris 10 vnode cached path and those bugs will be fixed in an upcoming patch some time after August 15, 2005.

When Solaris 10 lsof reports a path for an open VxFS file obtained via the VxFS Reverse Name Lookup facility, the path will be correct.

Also see the answers to the questions "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why doesn't Solaris lsof report VxFS path name components?"

#### 17.19 Large file problems

##### 17.19.1 Why does lsof complain it can't stat(2) a Solaris 2.5.1 large file?

When given an argument that is the path to a Solaris 2.5.1 file, enable for large file operations with the `O_LARGEFILE` `open(2)` option, lsof complains that it can't `stat(2)` the file. That's because lsof isn't using a `stat(2)` call and associated structure enabled for large files.

This error has been fixed, starting at lsof revision 4.58 for Solaris 2.6 and above. That fix won't work on Solaris 2.5.1 and I no longer have access to a Solaris 2.5.1 test system to develop a separate fix.

The work-around is to avoid specifying a `O_LARGEFILE` path as an argument to lsof on Solaris 2.5.1. Instead use a combination of lsof and `grep` to achieve the same results, albeit more clumsily.

##### 17.20 Why does lsof get a segmentation fault on 64 bit Solaris 8 using NIS+?

I have received a report from Gary Craig that lsof produces a segmentation fault on his 64 bit Solaris 8 system using NIS+. Via an independent test program we have exonerated lsof and tracked the fault to the NIS+ `__nis_server_name()` function in the C name server library, `-lnsl`.



Lsof causes the `__nis_server_name()` NIS+ function to be called by calling `getservent()` to read entries of the port number to service name map.

The only Sun bug ID that appears to describe the problem is 4304244, although its text is unclear enough to leave room for doubt.

Until Sun eliminates the `__nis_server_name()` segmentation fault cause, a work-around for lsof is to use its "-P" option, causing lsof to avoid port to service name lookups.

#### 17.21 Will lsof crash the Solaris kernel?

I've received and investigated one report that it has when the Sun hardware (a QME interface) was faulty. Today (May 23, 2002) I've learned that Sun has reports of kernel crashes caused by adb, lsof, and mdb.

The Sun investigation pinpointed a problem in the `/dev/kmem` kernel driver and there is a Sun bug report, 4344513, about the problem. There is a fix in Solaris 9, and patches for Solaris 7 and 8 (SPARC and x86).

To see if your Solaris system is fixed, look for a `/devices/pseudo/*allkmem` node.

Extensive address filtering was added to lsof revision 4.50 to forestall what I then (July 2001) believed to be only the possibility that lsof might crash Solaris. However, the filtering isn't perfect, since a filtered address might become invalid after lsof has filtered it but before lsof has delivered it to `/dev/kmem`. That filtering work is described in `.../dialects/sun/solaris_kaddr_filters`, also available at:

[ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/solaris\\_kaddr\\_filters](ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/solaris_kaddr_filters)

The best and safest work-around is to upgrade to Solaris 9 or install an appropriate patch or its equivalent from this list:

Solaris SPARC	x86	
Version	Patch	Patch
=====	=====	=====
7	106541-20	106542-20

## 17.22 Why does lsof on Solaris 7, 8, or 9 report a kvm\_open() failure?

When lsof is started on some Solaris 7, 8, and 9 systems it may report:

```
lsof: kvm_open(namelist=default, corefile=default): \
No such file or directory
```

Lsof revisions 4.65 and later will first report:

```
lsof: cannot stat /dev/allkmem
```

The second message, not delivered in lsof revisions below 4.65, explains the cause of the kvm\_open() failure; it can't find /dev/allkmem.

/dev/allkmem is a device added to Solaris 7 and 8 in patches and in the Solaris 9 FCS. See the preceding "Will lsof crash the Solaris kernel?" section for more information on /dev/allkmem and the patches.

The kvm\_open(3KVM) function in the KVM library of patched Solaris 7 and 8 systems and in Solaris 9 expects to find /dev/allkmem and exits on error when it does not.

If you have installed the patch that updated your KVM library to a version that expects /dev/allkmem to be present and it is not, you may need to reconfigure your system's devices with devfsadm(1M) or enter "boot -r" to the OpenBoot monitor's prompt (usually "ok").

## 17.23 Solaris and SAM-FS

### 17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?

Lsof 4.68 and above report "(limited SAM-FS info)" on Solaris in the NAME column after the path or file system name for all files it finds on SAM-FS file systems.

That's because no more information is known about the composition of the nodes that follow SAM-FS vnodes. If you can provide that information, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the

"Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 17.23.2 Why can't lsof locate named SAM-GS files?

Solaris lsof 4.68 and above can't locate files on SAM-FS file systems when the files are named as lsof arguments because lsof doesn't know how to locate open SAM-FS file device and node number information. (See also 'Why does Solaris lsof report "(limited SAM-FS info)?')

#### 17.24 Lsof and Solaris 10 zones

##### 17.24.1 How can I make lsof list the Solaris zone?

Use the lsof "-z [z]" option.

##### 17.24.2 Why doesn't lsof work in a Solaris 10 zone?

When run from within a Solaris 10 zone, lsof will usually report:

```
lsof: can't stat(/devices): No such file or directory
```

That's because a Solaris zone usually has no /devices subdirectory, a restriction of the zone implementation intended to limit the ability of zone processes to control global system resources, including physical devices.

While a zone may have a /dev subdirectory, that subdirectory usually lacks the /dev/allkmem, /dev/mem and /dev/kmem devices lsof and the KVM library it uses require.

The work-around is to run lsof in the global zone. When it is run in a global zone lsof will be able to report on processes running in any zone, including the global zone.

##### 17.24.3 Why does lsof complain it can't stat() Solaris 10 zone file systems?

When run from the global zone on Solaris 10 lsof may complain:

```
lsof: WARNING: can't stat() 15 zone file systems;
using dev= options
```

The warning message means lsof found the reported number of file system entries in the mount table for which it didn't have

permission to get stat(2) results, but which had "zone=" and "dev=" mount table options.

That is a normal restriction of Solaris 10 zones. Since the lsof warning message indicates it was able to find "dev=" options for the file systems, lsof will probably work correctly.

One work-around is to relax the restrictions on zone mount points, so that lsof can stat() them. While that may be possible by changing directory modes or group ownerships, it is probably not a good idea, because it weakens the restrictions zones are intended to provide.

Another work-around is to suppress the warning message with lsof's "-w" option. The down side of that is that it causes the suppression of all warning messages, leading to the possibility that some non-stat() warning messages will be suppressed.

## 17.25 Solaris 10 problems

### 17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?

When a path name component is renamed -- e.g., with mv(1) -- Solaris 10 lsof may report the old component for an open file that used the component in its path before the rename. That's because Solaris 10 lsof reports the path name cached in the open file's vnode and the Solaris 10 kernel doesn't update the open vnode's cached path name when a component of it is changed.

When an open file is deleted -- e.g., with rm(1) -- the path name by which it was opened remains cached in the vnode. Lsof can be instructed to display that path name with the -X option. The path name might be incorrect because of the rename problem described above. See the answer to the "What does "(deleted)" mean in the NAME column of a Solaris 10 open file?" question for more information.

Lsof is sometimes able to detect that cached path name is incorrect. In that case lsof may report only the mounted-on directory and device of the file system or it may report that the path name is of questionable accuracy by appending a trailing "(?)" to it in the NAME column.

See the answer to the "Why does Solaris 10 lsof sometimes

report only the mounted-on directory and device?" and 'What does "(?)" mean in the NAME column of a Solaris 10 open file?' questions for more information.

#### 17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?

For some regular open files lsof may report only the mounted-on directory and device of the file system on which the file resides. That's because lsof was able to determine that the path name cached in the open file's vnode is incorrect.

lsof detects the cached path name is incorrect by applying `stat(2)` to it, provided that no error was detected when `stat(2)` was applied to the file system mounted-on directory during lsof setup. If a mounted-on directory `stat(2)` error was detected during setup, lsof does no cached path name analysis and simply reports it.

When the application of `stat(2)` to the cached path name returns a no-entry reply (the `ENOENT` error number), lsof concludes the path no longer exists (i.e., has been unlinked) and reports the mounted-on directory and device of the file system. That behavior can be modified with the `-X` option in lsof revisions 4.77 and above. See the answer to the 'What does "(deleted)" mean in the NAME column of a Solaris 10 open file?' for more information.

When the application of `stat(2)` to the cached path name returns a permission error reply (the `EACCES` or `EPERM` error numbers), lsof reports the cached path name and adds a trailing "(?)" to indicate the reported path name is of questionable accuracy. See the answer to the question 'What does "(?)" mean in the NAME column of a Solaris 10 open file?' for more information.

If the application of `stat(2)` to the cached path name yields any other error reply, lsof reports the mounted-on directory and device of the file system.

When the application of `stat(2)` to the cached path name succeeds, lsof compares the reported device and node numbers to what it has obtained for the open file from kernel structures. If they match, lsof reports the cached path name. If they don't match, lsof instead reports the mounted-on directory and device of the file system.

A work-around that allows lsof to apply stat(2) successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?

When the -X option is specified to Solaris 10 lsof, it will report in its NAME column the path name cached for a deleted file in its vnode. The path name will be followed by "(deleted)".

Note that the path name cached in a file's vnode is the path name by which the file was opened. It is not updated by the Solaris kernel when any path name component is changed. Hence, it may not represent the final path name the open file had.

See the answer to the "Why does Solaris 10 lsof sometimes report the wrong path name?" question for more information on how changing a path name component affects the correctness of what lsof reports.

17.25.4 What does "(?)" mean in the NAME column of a Solaris 10 open file?

When lsof encounters a path name cached in the open file's vnode that stat(2) reports lsof lacks permission to access, lsof adds "(?)" to the path name reported in the NAME column to indicate the path name is of questionable accuracy.

See the answers to the "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?" questions for more information on why lsof may report a path name of questionable accuracy.

A work-around that allows lsof to apply stat(2) successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

17.26 Solaris contract file problems

17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?

Lsof doesn't report size, link count or node number for Solaris

10 contract files because I don't know how to obtain them from contract file kernel structures.

#### 17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?

Because lsof can't find the node number of Solaris contract files, it can't match the device and node numbers it gets from applying `stat(2)` to the contract file path name with what it finds in kernel data.

#### 17.27 Solaris 10 ZFS problems

##### 17.27.1 Why does Configure ask for the location of ZFS header files?

To provide ZFS support when lsof is compiled it needs to have access to the definitions of ZFS structures used by the kernel. Those definitions are contained in header files that Sun does not distribute with Solaris 10.

When the Configure script detects the system might support ZFS by finding the `<sys/fs/zfs.h>` header file, it checks for the required ZFS kernel structure definition header files. When they are not found, it asks if ZFS support should be included and if so, with what definitions.

Two sources can be declared for definitions: 1) lsof's internal ones; or 2) the necessary header files at some location other than `/usr/include/sys`.

The necessary header files are:

```
dmu.h zfs_acl.h zfs_debug.h zfs_rlock.h zil.h
spa.h zfs_context.h zfs_dir.h zfs_vfsops.h zio.h
txg.h zfs_ctldir.h zfs_ioctl.h zfs_znode.h zio_impl.h
```

The necessary header files might have been obtained, for example, from the <http://src.opensolaris.org> Open Solaris source site. However, the Open Solaris header files might not be adequate -- see the answer to the "Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?" question for information on why the Open Solaris ZFS header files might not provide correct ZFS kernel structure definitions.

The supplied header file path must point to a directory that contains a `sys/` subdirectory where the matching header files

are located -- e.g., if the supplied path is /tmp/zfs, then /tmp/zfs/sys must contain the necessary header files.

See the answer to the "Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?" question for information on the risks associated with using lsof's internal definitions.

#### 17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?

When lsof is configured to use its internal ZFS kernel structure definitions, there is the chance that the definitions may be out of date. Hence, an lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

Please contact me via e-mail at <abe@purdue.edu> for work-around suggestions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?

The Open Solaris ZFS header files may not provide correct ZFS kernel definitions. An lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

The definitions may be incorrect because the Open Solaris header files are not synchronized with any particular Solaris 10 release. Consequently they might contain modifications to the structures not in the structure definitions used to build the running kernel. It may be that only Sun has header files that match the kernel structures of the running Solaris 10 kernel.

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#### 17.28 Problems with Solaris 9 and above

##### 17.28.1 Why does the compiler complain about lgrp\_root on Solaris 9 and above?



When compiling lsof 4.84 on later Solaris 9 and 10 systems, the compiler may report the following error:

```
/usr/include/sys/lgrp.h", line ...: identifier redeclared: lgrp_root
```

This error results from a conflict between usage of `lgrp_root` in both `<sys/lgrp.h>` and `<sys/lgrp_user.h>` when `_KMEMUSER` or `_KERNEL` is `#define'd` before `<sys/lgrp.h>` is `#include'd`. This problem is noted in SunSolve bug ID 5064229.

The work-around is to use lsof revision 4.85 sources.

## 18.0 Lsof Features

### 18.1 Why doesn't lsof report on /proc entries on my system?

/proc file system support is generally available only for BSD, SYSV R4 dialects, and Tru64 UNIX (Digital UNIX, DEC OSF/1). It's also available for Linux, and Pyramid DC/OSx and Reliant UNIX.

Even on some SYSV R4 dialects I encountered many problems while trying to incorporate /proc file system support. The chief problem is that some vendors don't distribute the header file that describes the /proc file system node -- usually called `prdata.h`.

### 18.2 How do I disable the device cache file feature or alter it's behavior?

To disable the device cache file feature for a dialect, remove the `HASDCACHE` definition from the `machine.h` file of the dialect's `machine.h` header file. You can also use `HASDCACHE` to change the default prefix (``.lsof'`) of the device cache file.

Be sure you consider disabling the device cache file feature carefully. Having a device cache file significantly reduces lsof startup overhead by eliminating a full scan of `/dev` (or `/devices`) once the device cache file has been created. That full scan also overloads the kernel's name cache with the names of the `/dev` (or `/devices`) nodes, reducing the opportunity for lsof to find path name components of `open`

files.

If you're worried about the presence of mode 0600 device cache files in the home directories of the real user IDs that execute lsof, consider these checks that lsof makes on the file before using it:

1. To read the device cache file, lsof must gain permission from access(2).
2. The device cache file's modes must be 0600 (0644 if lsof is reading a system-wide device cache file) and its size non-zero.
3. There must be a correctly formatted section count line at the beginning of the file.
4. Each section must have a header line with a count that properly numbers the lines in the section. Legal sections are device, clone, pseudo-device, and CRC.
5. The lines of a section must have the proper format.
6. All lines are included in a 16 bit CRC, and it is recorded in a non-checksummed section line at the end of the file.
7. The checksum computed when the file is read must match the checksum recorded when the file was written.
8. The checksum section line must be followed by end-of-information.
9. lsof must be able to get matching results from stat(2) on a randomly chosen entry of the device section.

For more information on the device cache file, read the 00DCACHE file of the lsof distribution.

#### 18.2.1 What's the risk with a perverted device cache file?

Even with the checks that lsof makes on the device cache file, it's conceivable that an intruder could modify it so it would pass lsof's

tests.

The only serious consequence I know of this change is the removal of a file whose major device number identifies a socket from some user ID's device cache file. When such a device has been removed from the device cache file, and when lsof doesn't detect the removal, lsof may not be able to identify socket files when executed by the affected user ID. Only certain dialects are at risk to this attack -- e.g., SCO OpenServer and Solaris 2.x, 7, 8, and 9.

If you're tracking a network intruder with lsof, that could be important to you. If you suspect that someone has corrupted the device cache file you're using, I recommend you use lsof's `-Di` option to tell it to ignore it and use the contents of `/dev` (or `/devices`) instead; or remove the device cache file (usually `.lsof_hostname`, where `hostname` is the first component of the host's name returned by `gethostname(2)`) from the user ID's home directory and let lsof create a new one for you.

18.2.2 How do I put the full host name in a personal device cache file path?

Lsof constructs the personal device cache file path name from a format specified in the `HASPERSDC #define` in the dialect's `machine.h` header file. As distributed `HASPERSDC` declares the path to be ``.lsof_`` plus the first component of the host name with the format ``.lsof_%L``.

If you want to change the way lsof constructs the personal device cache file path name, you can change the `HASPERSDC #define` and recompile lsof. If, for example, you `#define HASPERSDC` to be ``.lsof_%l`` (note the lower case ``l``), Configure and remake lsof, then the personal device cache file path will be ``.lsof_`` plus the host name returned by `gethostname(2)`.

See the `00DCACHE` file of the lsof distribution for more information on the formation of the personal device cache file path and the use of the `HASPERSDC #define`.

18.2.3 How do I put the personal device cache file in `/tmp`?

Change the `HASPERSDC` definition in your dialect's `machine.h` header

file.

When you redefine HASPERSDC, make sure you put at least one user identification conversion in it to keep separate the device cache files for each user of lsof. Also give some thought to including the ``%0" conversion to define an alternate path for setuid-root and root processes.

Here's a definition that puts a personal device cache file in /tmp with the name ``.lsof\_login\_hostname\_pers".

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers"
```

Thus the /tmp personal device cache file path for login "abe" on host "lsof.itap.purdue.edu" would be:

```
/tmp/.lsof_abe_lsof.itap.purdue.edu_pers
```

You can add the User ID (UID) with the "%U" conversion and the first host name component with the ``%L" conversion.

CAUTION: be careful using absolute paths like /tmp lest lsof processes that are setuid-root or whose real UID is root be used to exploit some security weakness via /tmp. Elect instead to add an alternate path for those processes with the ``%0" conversion.

Here's an extension of the previous HASPERSDC format for /tmp that declares an alternate path:

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers%0%h/.lsof_%L"
```

When the lsof process is setuid-root or its real UID is root, presuming root's home directory is `/ and the host's name is ``lsof.itap.purdue.edu", the extended format yields:

```
/.lsof_vic
```

### 18.3 Why doesn't lsof know about AFS files on my favorite dialect?

lsof currently supports AFS for these dialects:

- AIX 4.1.4 (AFS 3.4a)
- Linux 1.2.13 (AFS 3.3)
- NEXTSTEP 3.2 (AFS 3.3)
- Solaris 2.[56] (AFS 3.4a)

It may recognize AFS files on other versions of these

dialects, but I have no way to test that. Lsof may report correct information for AFS files on other dialects, but I can't test that either.

AFS support must be custom crafted for each UNIX dialect and then tested. If lsof supports your favorite dialect, but doesn't recognize its AFS files, probably I don't have access to a test system. If you want AFS support badly for your dialect, consider helping me do the development and testing.

18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?

When AFS is implemented via dynamic kernel modules -- e.g., in NEXTSTEP -- lsof can't obtain the addresses of AFS variables in the kernel that it uses to identify AFS vnodes. It can guess that a vnode is assigned to an AFS file and it can obtain other information about AFS files, but it has trouble computing AFS volume node numbers.

To determine node numbers for AFS volumes other than the root volume, /afs, lsof needs access to a hashed volume structure pointer table. When it can't find the address of that table, because AFS support is implemented via dynamic kernel modules, lsof will return blanks in the INODE column for AFS volume files. Lsof can identify the root volume's node number (0), and can compute the node numbers for all other AFS files.

If you have a name list file that contains the addresses of the AFS dynamic modules -- e.g., you saved module symbols when you created a loadable module kernel with modload(8) by specifying -sym -- lsof may be able to find the kernel addresses it needs in that file.

Lsof looks up AFS dynamic kernel addresses for these dialects at these default paths:

NEXTSTEP 3.2 /usr/vice/etc/afs\_loadable

A different path to a name list file with AFS dynamic kernel addresses may be specified with the -A option, when the -A option description appears in lsof's -h or -? (help) output.

If any addresses appear in the -A name list file that also

appear in the regular kernel name list file -- e.g., /vmunix  
-- they must match, or lsof will silently ignore the -A  
addresses on the presumption that they are out of date.

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  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/n+obsd/dnode1.c
  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/osr/dsock.c
  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/kmem/dnode1.c
  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/osr/machine.h
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  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/lsof-4-85-zip/lib/rnmh.c
  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/lsof-4-85-zip/dialects/sun/dnode2.c
  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/lsof-4-85-zip/lib/rnam.c
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  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/lsof-4-85-zip/dialects/linux/dproc.c
  - \* /opt/cola/permits/1550988360\_1675319900.3624527/0/lsof-4-85-zip/dialects/linux/dmnt.c
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\* \$Id: pfsnode.h,v 1.1 1993/12/12 12:26:39 davidg Exp \$  
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\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/tests/LTnlink.c

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/tests/LTbigf.c

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/tests/LTszooff.c

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/tests/LTsock.c

\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/tests/LTunix.c

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- \* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/machine.h
- \* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/dsock.c
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\*

```

/opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/darwin/kmem/ddev.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+os/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+obsd/dlsof.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/du/dlsof.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/aix/dfile.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/freebsd/dproc.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+obsd/dstore.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+os/dlsof.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/aix/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/du/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/misc.c
*
/opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/proc.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/sun/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/darwin/kmem/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/du/dproc.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/darwin/kmem/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/darwin/kmem/dmnt.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/freebsd/dlsof.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/kmem/dfile.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/du/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/kmem/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/freebsd/dmnt.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/aix/dsock.c
*
/opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/lsof_fields.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/aix/ddev.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/aix/dstore.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/arg.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/kmem/dproc.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+os/dstore.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/sun/dlsof.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/sun/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/kmem/dmnt.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+os/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/aix/dproc.c
*
/opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+os/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/darwin/kmem/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+obsd/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+os/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/aix/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/freebsd/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/du/dstore.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/n+obsd/dmnt.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/node.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/kmem/dlsof.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/darwin/kmem/dlsof.h

```



```

*
/opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/ddev.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/freebsd/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/dmnt.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/dstore.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+obsd/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/freebsd/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/freebsd/dstore.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+os/dproc.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dnode.c
*
/opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/kmem/dproc.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/dfile.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/proto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/kmem/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/freebsd/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/Isf.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+obsd/dsock.c

```

No license file was found, but licenses were detected in source scan.

```

/*
* Copyright 1994 Purdue Research Foundation, West Lafayette, Indiana
* 47907. All rights reserved.
*
* Written by Victor A. Abell
*
* This software is not subject to any license of the American Telephone
* and Telegraph Company or the Regents of the University of California.
*
* Permission is granted to anyone to use this software for any purpose on
* any computer system, and to alter it and redistribute it freely, subject
* to the following restrictions:
*
* 1. Neither the authors nor Purdue University are responsible for any
* consequences of the use of this software.
*
* 2. The origin of this software must not be misrepresented, either by
* explicit claim or by omission. Credit to the authors and Purdue
* University must appear in documentation and sources.
*
* 3. Altered versions must be plainly marked as such, and must not be
* misrepresented as being the original software.

```

```

*
* 4. This notice may not be removed or altered.
*/
/*
* GetOpt() -- Local get option
*
* Liberally adapted from the public domain AT&T getopt() source,
* distributed at the 1985 UNIFORM conference in Dallas
*
* The modifications allow '?' to be an option character and allow
* the caller to decide that an option that may be followed by a
* value doesn't have one -- e.g., has a default instead.
*/

```

Found in path(s):

```
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/main.c
```

No license file was found, but licenses were detected in source scan.

#### Notes for the distribution of lsof version 4

```

| The latest release of lsof is always available via anonymous ftp |
| from lsof.itap.purdue.edu. Look in pub/tools/unix/lsof. |

```

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4.38, November 25, 1998  
4.39, December 29, 1998  
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4.41, February 27, 1999  
4.42, March 30, 1999  
4.43, May 11, 1999  
4.44, June 24, 1999  
4.45, July 30, 1999  
4.46,

October 23, 1999  
4.47, November 29, 1999  
4.48, January 14, 2000  
4.49, April 3, 2000  
4.50, June 29, 2000  
4.51, August 21, 2000  
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4.53, December 6, 2000  
4.54, January 19, 2001  
4.55, February 15, 2001  
4.56, May 3, 2001  
4.57, July 19, 2001  
4.58, September 13, 2001  
4.59, October 20, 2001  
4.60, November 9, 2001  
4.61, January 22, 2002  
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4.63, April 23, 2002  
4.64, June 26, 2002  
4.65, October 10, 2002  
4.66, December 22, 2002  
4.67, March 27, 2003  
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4.80, May 12, 2008  
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4.82, March 25, 2009  
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4.84, July 29, 2010  
4.85, September 27, 2011

## Dialects Supported

=====

Lsof (for LiSt

Open Files) lists files opened by processes on  
selected Unix systems. Version 4 is a source reorganization of

version 3, itself a major revision of version 2. Version 4 has been tested on:

AIX 5.3

Apple Darwin 9 and Mac OS X 10.[56]

FreeBSD 4.9 and 6.4 for x86-based systems

FreeBSD 8.[02] and 9.0 for AMD64-based systems

Linux 2.1.72 and above for x86-based systems

Solaris 9, 10 and 11

(The pub/tools/unix/lsof/contrib directory on lsof.itap.purdue.edu contains information on other ports.)

If your favorite Unix dialect is not in the list, or if your version of it is more recent than the ones listed, please contact me at <abe@purdue.edu>.

Version 3 of lsof was tested on:

AIX 3.2.5, 4.1.[1234], and 4.2

BSDI BSD/OS 2.0, 2.0.1, and 2.1 for x86-based systems

DC/OSx 1.1 for Pyramid systems

Digital UNIX (DEC OSF/1) 2.0, 3.0, 3.2, and 4.0

EP/IX 2.1.1 for the CDC 4680

FreeBSD 1.1.5.1, 2.0, 2.0.5, 2.1, 2.1.5 for x86-based systems

HP-UX 8.x, 9.x, 10.01, 10.10, and 10.20

IRIX

5.2, 5.3, 6.0, 6.0.1, and 6.[124]

Linux through 2.0.27 for x86-based systems

NetBSD 1.0, 1.1, and 1.2 for x86 and SPARC-based systems

NEXTSTEP 2.1 and 3.[0123]

OpenBSD 1.2 and 2.0 for x86-based systems

Reliant UNIX 5.43 for Pyramid systems

RISC/os 4.52 for MIPS R2000-based systems

SCO OpenServer Release 1.1, 3.0, and 5.0.x for x86-based systems

SCO UnixWare 2.1 and 2.1.1 for x86-based systems

Sequent PTX 2.1.[1569], 4.0.[23], 4.1.[024], 4.2[.1], and 4.3

Solaris 2.[12345], 2.5.1, and 2.6-Beta

SunOS 4.1.x

Ultrix 4.2, 4.3, 4.4, and 4.5

Version 3 and its predecessor, version 2, may be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD>

## How Lsof Works

=====

Using available kernel data access methods -- `getproc()`, `getuser()`, `kvm_*`, `nlist()`, `pstat()`, `read()`, `readx()`, `/proc` -- `lsof` reads process table entries, task table entries, user areas and file pointers to reach the underlying structures that describe files opened by processes.

### Lsof interprets

most file node structures -- `advfsnodes`, `autonodes`, `cnodes`, `cdnodes`, `devnodes`, `fifonodes`, `gnodes`, `hsnodes`, `inodes`, `mfsnodes`, `pcnodes`, `procnodes`, `rnodes`, `snodes`, `specnodes`, `s5inodes`, `tmpnodes`. It understands NFS connections. It recognizes FIFOs, multiplexed files, Unix and Internet sockets. It knows about streams. It understands `/proc` file systems for some dialects. On many dialects it recognizes execution text and library references. It knows about AFS on some Unix dialects.

## Lsof Output

=====

The `lsof` output describes:

- \* the identification number of the process (PID) that has opened the file;
- \* the process group identification number (PGID) of the process (optional);
- \* the process identification number of the parent process (PPID) (optional);
- \* the command the process is executing;
- \* the owner of the process;
- \* for all files in use by the process, including the executing text file and the shared libraries it is using:
  - \* the file descriptor number of the file, if applicable;
  - \* the file's access mode;
  - \* the file's lock status;

- \* the file's device numbers;
- \* the file's inode number;
- \* the file's size or offset;
- \* the name of the file system containing the file;
- \* any available components of the file's path name;
- \* the names of the file's stream components;
- \* the file's local and remote network addresses;
- \* the TLI network (typically UDP) state of the file;
- \* the TCP state, read queue length, and write queue length of the file;
- \* the file's TCP window read and write lengths (Solaris only);
- \* other file or dialect-specific values.

### Getting Started Quickly

=====

If you want to get started using `lsf` quickly, or see some examples of how `lsf` can be used, consult the `00QUICKSTART` file of the `lsf` distribution.

The `00QUICKSTART` file won't help you build or install `lsf`, but it will cut

through the density of the `lsf` man page, giving you more readily an idea of what you can do with `lsf`.

For information on building and installing `lsf`, consult the `00README` file of the `lsf` distribution.

### Limiting, Filtering, and Selecting Lsf Output

=====

`lsf` accepts options to limit, filter, and select its output.

These are the possible criteria:

- \* Process ID (PID) number -- to list the open files for a given process;
- \* Process Group ID (PGID) -- to list the open files for all the processes of a given process group;
- \* User ID number or login name -- to list the open files for all the processes of a given user;
- \* Internet address -- to list the open files using a given Internet address (host name), protocol, or port (number or name); or to list all open Internet files;
- \* command name;
- \* file descriptor name or number;
- \* list all open NFS files;
- \* list all open Unix domain socket files;
- \* list all uses of a specific file;
- \* list all open files on a file system.

Selection options are normally ORed -- i.e., an open file meeting any of the criteria is listed. The selection options may be ANDed so that an open file will be listed only if it meets all the criteria.

In the absence of any selection criteria, lsof lists files open to all processes.

#### Parsing Lsof Output with Another Program

=====

The lsof -F option directs it to produce "field" output that can easily be parsed by another program. The lsof distribution contains sample awk, perl 4, and perl 5 scripts in its scripts subdirectory that show how to post-process field output.

#### Repeat Mode

=====

Lsof can be directed to produce output, delay for a specified time,



then repeat the output, cycling until stopped by an interrupt or quit signal. This mode is useful for monitoring the status of some file operation -- e.g., an ftp transfer or a tape backup operation.

Repeat mode is more efficient when combined with lsof's selection options, since they limit lsof overhead.

It's possible to use lsof's field output options to supply repeat mode output to another process for its manipulation. The scripts subdirectory of the lsof distribution has sample Perl scripts showing how to consume lsof repeat mode output from a pipe.

#### Distribution Restrictions

=====

Lsof may be used and distributed freely, subject to these limitations:

1. Neither the author nor Purdue University is responsible for any consequences of the use of this software.
2. The origin of this software must not be misrepresented, either by explicit claim or by omission. Credit to the author and Purdue University must appear in documentation and sources.
3. Altered versions must be plainly marked as such, and must not be misrepresented as being the original software.
4. This notice may not be removed from or altered in the lsof source files.

#### Cautions

=====

Lsof is a tool that is closely tied to the Unix operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version.

**DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER.**

On some Unix dialects, notably SunOS and Solaris, lsof versions may be even more restricted by architecture type. An lsof binary, compiled for SunOS 4.1.3 on a sun4c machine, for example, won't work on a sun4m machine.

AN LSOF BINARY, COMPILED FOR ONE SOLARIS 1.X ARCHITECTURE, ISN'T GUARANTEED TO WORK ON A DIFFERENT SOLARIS 1.X ARCHITECTURE.

## Distribution Contents

=====

The lsof distribution is checked for completeness when it is constructed and by the Inventory script when you run the Configure script. (See The Inventory Script section of the 00README file of this distribution.)

Lsof is organized in these parts:

- \* The main lsof directory, containing common sources, configuration and setup scripts and three subdirectories: dialects/, lib/, and scripts/.

Lsof is compiled in the main lsof directory after configuration. The selected dialect sources are copied or linked from the specified subdirectory. (Symbolic linking is the standard method.)

Common lsof definitions may be found in lsof.h; common function prototypes, proto.h; and common storage, store.c.

- \* The dialects/ subdirectory contains subdirectories with sources specific to UNIX dialect implementations -- e.g., the dialects/sun/ subdirectory contains sources for the SunOS (Solaris 1.x) and Solaris (2.x) implementations of lsof. The dialects subdirectories also contain Makefiles and scripts for assisting dialect source configuration.

Dialect configuration definitions may be found in dlsof.h; other dialect definitions, dlsof.h; dialect prototypes,

dproto.h; and dialect storage, dstore.c.

- \* The lib/ subdirectory contains sources for common lsof functions. Not all dialects use the functions -- some have their own versions of them. The lib/ functions are enabled and customized with #define's in the dialect machine.h header files.

- \* The scripts/ subdirectory contains sample scripts for processing lsof field (-F) output. The scripts are written

in AWK, Perl 4, and Perl 5.

The 00PORTING file of the lsof distribution has more information on lsof components, configuration, and construction.

#### Warranty

=====

Lsof is provided as-is without any warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of lsof is with you. Should lsof prove defective, you assume the cost of all necessary servicing, repair, or correction.

#### Bug

##### Reports

=====

Now that the obligatory disclaimer is out of the way, let me hasten to add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND A BUG REPORT ABOUT LSOF TO THE UNIX DIALECT VENDOR.

At worst such a bug report will confuse the vendor; at best, the vendor will forward the bug report to me.

Please send all bug reports, requests, etc. to me via email at <abe@purdue.edu>.

#### The lsof-l Mailing List

=====

Information about lsof, including notices about the availability of new revisions, may be found in mailings of the lsof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the lsof distribution.

#### Version 3 Release Notes

=====

See 00DIST in the last lsof 3 revision 3.88, for its complete set of release notes. Lsof revision 3.88 may be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD>

3.0 May 24, 1994

This is the first official release of lsof 3.

...

3.88 February 17, 1997

```
+=====+
| This is the last version 3 revision. |
+=====+
```

Added documentation files -- 00.README.FIRST[\_<version>] and 00RELEASE.SUMMARY\_<version> -- to the distribution.

What's new in Version 4

=====

The main goal of version 4 was to eliminate the confusing common/fragment source file technique. Changing the version number also provided an opportunity to restart the numbering, which at 3.88 had risen to a large value.

The sources that appeared in the dialects/common subdirectory of version 3 in fragment files have been incorporated into the version 4 liblsof.a library as \*.c files. This results in significant changes to many source files, scripts, and Makefiles of all dialect versions. It allows elimination of some source files -- ddev.c, dfile.c, dmnt.c -- for dialects now obtaining functions from liblsof.a that formerly came from making dialect source files by combining fragment files.

The version 4 liblsof.a sources are stored in the lib/ subdirectory of the main lsof directory. The liblsof.a functions are activated and conditioned in their source files by values #define'd in the dialect dlsof.h and machine.h header files.

Dialects that provide a private version of a library function refrain from #define'ing the symbol that would activate the library function code.

## Version 4 Release Notes

=====

4.0 February 24, 1997

+-----+  
| This is the first lsof 4 revision. |  
+-----+

Reorganized sources: eliminated code fragment files and created a library in their place. Modified or deleted many dialect source and header files. Changed documentation accordingly.

Added a warning to sgi/Makefile and 00FAQ that advises against using the IRIX C compiler -n32 option when compiling lsof. Thanks go to Peter Ilieve <peter@memex.co.uk> for bringing this to my attention.

Dropped IRIX 5.2 in mid-stream, because my 5.2 test system was upgraded to 5.3.

4.01 March 3, 1997

Added TFS support for Pyramid dialects.

Added test to Configure and to the IRIX dnode.c for the different cnode struct that appears in <cache/fs/cache/fs.h> on the 6.2 IMPACT distribution. Heddy Boubaker <boubaker@amfou.cenatls.cena.dgac.fr> alerted me to the cnode change and helped test this lsof adjustment.

Shut down the lsof child process before doing a -r sleep(). A comment from Dan Mercer <dam@mmm.com> prompted this.

4.02 March 21, 1997

Based on a report from Pasi Kaara <Pasi.Kaara@atk.tpo.fi>, disabled HP-UX CCIT support in lsof for HP-UX versions 10 and above. Pasi's report also led to changes in the HP-UX machine.h to support use of gcc to compile lsof for HP-UX 10.20 and warnings against using `cc -Aa` or `gcc -ansi` to compile lsof under HP-UX 10.x.

With help from Richard Allen <ra@hp.is> taught HP-UX 10.x lsof to name file systems better by using the virtual file system device number. Elias Halldor Agustsson <elias@rhi.hi.is> provided a test system.

Changed NEXTSTEP and UNIXWARE Makefiles to use safer quoting when generating version.h. The change was suggested by Bob Farmer <ucs\_brf@unx1.shsu.edu>.

Added SHELL=/bin/sh string to all Makefiles.

Added support for Linux 2.1.28 on a test system, kindly provided by Jonathan Sergent <sergent@purdue.edu>. Configure tests the Linux 2.1.x's C library lseek() function for proper handling of kernel offsets. If lseek() appears suspect, Configure activates the use of a private lseek() function. Changed the private nlist() function to nlist\_private() and taught it to use the query\_module() syscall in place of the deprecated get\_kernel\_syms() one. Added rudimentary AX.25 support for Pierfrancesco Caci <ik5pvx@infogroup.it> who helped test it. Updated the old get\_kernel\_syms() code to recognize and skip module name entries.

Prompted by Marty Leisner <leisner@sdsp.mc.xerox.com>, eased the requirement that service name lookup for the -i option be accompanied by a protocol name. The name is not needed if both TCP and UDP names yield the same port number.

Added xusers.awk script from Dan Mercer <damercer@mmm.com> to the distribution scripts/ subdirectory.

Changed Configure script to use LSOF\_VERS for all UNIX dialect version numbers and to pass LSOF\_VERS to the dialect Mksrc functions. Also added the ability for a dialect stanza to declare a different dialect Makefile source. Modified dialect Mksrc files -- e.g., linux and sun -- accordingly.

Added support for BSD/OS 3.0 with help from Jim Reid <jim@mpn.cp.philips.com>. Terry Kennedy <TERRY@spcvxa.spc.edu> kindly provided a test system. During the port corrected

a bug that prevented proper handling of revoked files.

#### 4.03 April 7, 1997

At the suggestion of Dan Mercer <damercer@mmm.com>, made HP-UX building of lsof aware of differences between the HP-UX bundled and unbundled C compilers.

Added the ability for the lsof builder to define the default warning message issuance state. By default the issuance of warning messages is disabled; defining WARNINGSTATE in machine.h disables it. The Customize script was updated to handle WARNINGSTATE. Dan Mercer suggested this.

Eliminated compiler complaint about improperly cast get\_NI\_value() argument in ncache\_load() in lib/rnch.c.

Corrected zeromem() argument error in SCO dproc.c. Sped up parent directory cache lookup slightly.

Updated for PTX 4.4, including additional VxFS (EFS) file system support.

#### 4.04 April 17, 1997

At the suggestion of Bela Lubkin <belal@sco.COM> changed device cache handling to be more tolerant of a device cache file whose [cm]times are older than the ones on /dev or /devices. The change required adding information to Solaris device cache file clone lines, so the first time lsof 4.04 is run under Solaris it will complain about a bad cached clone device in a previous device cache file, then regenerate it.

Added boot file path detection for SCO OSR 5 and above, based on information supplied by Bela.

Fixed two bugs in DEC OSF/1 lsof -- an error in reporting locks and a missing continue statement in readdev() after a failure to open a directory. Jan Ole Suhr <josuhr@informatik.tu-clausthal.de> reported the second bug and supplied a fix.

Fixed XFS problems with IRIX 6.2 by abandoning the idea that SGI will distribute XFS header files and defining an lsof-private xfs\_inode structure. John

Paul Morrison <John.Paul.Morrison@MultiActive.com>  
helped develop and test the 5.3 definition. John  
R. Vanderpool <fish@daacdev1.gsfc.nasa.gov> helped  
develop and test the 6.2 definition.

Remove  
obsolete comments about common/\*.frag files.

Updated Linux lsof for Linux version 2.1.35.

4.04 April 18, 1997

Supplement Regenerated the 4.04 distribution to correct a non-  
device-cache #define misplacement in the Solaris and  
SunOS dlsof.h. Alexandre Oliva <oliva@dcc.unicamp.br>  
reported the problem.

4.05 April 24, 1997

Corrected an error in 00DCACHE.

Made sure SCO /etc/ps/booted.systems is closed.

Based on an observation by Bela Lubkin <belal@sco.COM>  
that the lsof child had needless file descriptors  
open, closed all but the open pipes between the  
lsof parent and child.

Decommissioned CDC EP/IX support; I no longer have a  
test system.

Based on a suggestion from Patrick Connor  
<connor@phreak.csd.sgi.com>, added -xansi to CFLAGS  
for IRIX 5.3 and 6.[234].

Also at Patrick's suggestion changed Configure to  
propagate exact SunOS 4.1.x version to the main  
and library Makefiles. This allowed the sunos413  
and sunos413cc Configure abbreviations  
to be  
shortened to sunos and sunoscc.

Updated obsolete argument uses (-H changed to -n)  
in count\_pf.perl\* and watch\_a\_file.perl scripts.

Adjusted Solaris 2.6 lsof for Beta\_Update with tips  
from Casper Dik <casper@holland.Sun.COM>.

Fixed a Solaris 2.4 TCP address reporting bug.



4.06 April 30, 1997

Added a step to the Makefile clean rules that does a make clean in the lib subdirectory; suggested by Casper Dik <casper@holland.Sun.COM>. (Configure's -clean argument already did this.)

Fixed an incorrect awk argument in the sunos\*)  
Configure stanza, reported by Alexandre Oliva <oliva@dcc.unicamp.br>.

Added CD9660 (aka ISO) file system support to FreeBSD, NetBSD, and OpenBSD with mods and help from Kenneth Stailey <kstailey@disclosure.com>. (BSDI already had CD9660 support.) While at it, added file descriptor system support to BSDI and FreeBSD.

Added /kern file system support to OpenBSD. The support wasn't extended to BSDI, FreeBSD, or NetBSD, because it requires Kenneth Stailey's changes to /sys/miscfs/kernfs/kernfs.h.

Updated IRIX 6.3 support after getting access to a test system, provided by John Paul Morrison <John.Paul.Morrison@MultiActive.com>. Improved the handling of IRIX 5.1 and greater FIFOs.

4.07 May 12, 1997

Based on AIX problem reports from David Capshaw <David.Capshaw@SEMATECH.Org>, changed the aix\* Configure script stanza to avoid -bnolibpath for gcc (which the GNU loader doesn't grok) and AIX below 4.1.4 (where -bnolibpath hasn't been tested or is known to be unimplemented), and to refuse to use gcc for compiling lsof in AIX versions below 4.1 (because of possible structure alignment problems). Updated 00FAQ appropriately.

Added OpenBSD support for EXT2FS. This support has yet to be tested.

Tested lsof under OpenBSD 2.1.

Activated /kern file system support for NetBSD when Configure senses that /sys/miscfs/kernfs/kernfs.h defines the kern\_target

structure. This support has not been tested under NetBSD, although it has been tested under OpenBSD.

Made some simple changes to the BSDI machine.h, suggested by Jeffrey C. Honig <jch@bsd.com>.

Improved handling of alternate dialect Configure abbreviations -- aix and aixgcc, hpux and hpuxgcc, solaris and solariscc, and sunos and sunoscc.

4.08 May 23, 1997

Cleaned up dialect Makefile's, starting with a suggestion from Christopher Schanzle <chris@cam.nist.gov>.

Improved Configure's -clean processing.

Corrected bugs in Solaris lock reporting.

Changed NetBSD Configure stanza to put -I/usr/include before -I/sys.

4.09 June 1, 1997

Adjusted for latest FreeBSD 3.0 release. This required adding a new kernel name cache module for reading BSD-form hashed kernel name cache entries, rnmh.c, to the lsof library, and adding a #define to each machine.h to select it.

Activated rnmh.c for BSDI 2.1, BSDI 3.0, NetBSD 1.2, and OpenBSD 2.1.

4.10 June 8, 1997

Adjusted for Linux 2.1.x (x > 35) kernels with hashed task structure pointers. Marty Leisner <leisner@sdsp.mc.xerox.com> and Jonathan Sergent <sergent@io.com> tested the adjustment.

Replaced readdev() stat() calls with lstat() to reduce device table and cache entries with the same device number and inode values. Added code to remove all remaining duplicates. This fixes a Linux problem reported by Jonathan Sergent and makes device node name output predictable.

Corrected a bug in UnixWare stream file handling that prevented searching for the stream file by

its associated character device name.

Added Pyramid code to determine Reliant UNIX clone major device number differently from that of DC/OSx.

#### 4.11 June 12, 1997

Changed Configure to sense that the PTX `inp_[fl]addr` members of the `inpcb` structure of `<netinet/in_pcb.h>` have a struct type and set `HASINADDRSTR` for use in `PTX dnode.c` and `dsock.c` tests.

Changed PTX version 4.1.4 tests to use 4.1.3 instead.

Carson Wilson `<carson@mcs.com>` reported the need to do this and tested the change.

Fixed a block device table indexing bug in `lib/rdev.c`, reported by Carson Wilson. The same bug was squashed in `pyramid/ddev.c`.

Added code to the Pyramid Reliant UNIX `kread()` function to compensate for an address boundary error in the kernel's `/dev/kmem` driver.

Verified that `lsf` compiles and works under AIX 4.2.1. Added an AIX test for the presence of NFS header files, defined `HAS_NFS` and adjusted AIX dialect sources accordingly.

Based on a suggestion from Gaylord Holder `<holder@phy.ucsf.EDU>`, added DEC OSF/1 code to auto-detect the booted file, whence kernel symbol addresses are obtained.

#### 4.12 June 24, 1997

Corrected a device number sign extension problem in the reading and writing of device cache file.

The problem was reported by Bela Lubkin `<belal@sco.com>` and he suggested a fix.

Fixed an SCO stream device lookup problem. The report and solution came from Bela Lubkin

Enhanced the `Configure` script to enable cross-configuration of `lsf`, based on suggestions from Marty Leisner `<leisner@sdsp.mc.xerox.com>`. A new documentation file, `00XCONFIG`, describes the process.

Made Pyramid OBJFS support conditional on the presence of supporting header files. Corrected the Pyramid MkKernOpts script so it generates the necessary -D's for the Nile/Jolt architecture. Richard Coley <rcoley@pyra.co.uk> helped.

Added another IRIX xfs\_inode variant for 6.2, 32 bits, no XFS rollup patch.

Tested under UnixWare 2.1.2.

#### 4.13 July 9, 1997

Taught Pyramid lsdf to grok ttyfs vnodes with help from Richard Coley <rcoley@pyra.co.uk>. Fixed some minor bugs in Pyramid FIFO reporting. Eliminated use of the Pyramid UCB compatibility library at Richard's suggestion.

Eliminated reporting of "strange" inode numbers for SCO OSR 3.2v5.0.x HPPS files with help from Bela Lubkin <belal@sco.com>

#### Modified

port to service name lookup to use a small number of getservbyport() calls before reading the entire map with getservent(). Changed port reporting to represent a zero as `\*' to be consistent with other prt number reporting tools like netstat. Casper Dik <casper@holland.Sun.COM> suggested these changes -- the getserv\*() one to improve performance for large NIS service name maps.

Changed all readdev() functions to make the absence of block devices a warning instead of a fatal error after Brian Redman <ber@ms.com> reported his IRIX 6.4 system had no block devices. (It really did have block devices, but readdev()'s lstat() use caused it to miss them in a directory symbolically linked from /dev/dsk->/hw/disk.) Fixed Brian's real problem by changing the IRIX readdev() to use stat() on /dev nodes if a Configure test shows /hw is readable. Extended the potential to do the same to all readdev() functions.

For consistency and convenience changed some Configure

abbreviations and dialect subdirectory  
names: "decof" abbreviation and "osf" dialect  
subdirectory name to "du"; "netbsd" dialect  
subdirectory name to "n+obsd"; "next3" abbreviation  
and "next" dialect subdirectory name to "ns"; "sco"  
abbreviation and dialect subdirectory name to "osr";  
"sgi" dialect subdirectory name to "irix"; and  
"unixware" abbreviation and dialect subdirectory  
name to "uw".

Added #if/#endif clauses to the AIX rmdupdev()  
function to avoid clone processing for AIX versions  
less than 4.1.4. The problem was reported by Toralf  
Foerster <toralf.foerster@io-warnemuende.de>, who  
supplied corrective code.

Added support for new style NetBSD inode with i\_ffs  
and i\_e2fs union members.

Improved Configure and 00FAQ information on Digital  
UNIX configuration subdirectory with suggestions  
from Brad Krebs <brad@EECS.Berkeley.EDU>.

#### 4.14 July 22, 1997

Reorganized the Solaris handling of the inode  
structure header file, ufs\_inode.h,  
to eliminate  
VxFS structure definition conflicts for Solaris  
2.4, based on information from Greg Earle  
<earle@netbsd4me.jpl.nasa.gov>.

Cleaned up some typos and confusion in Configure's  
help output, based on comments from Bela Lubkin  
<belal@sco.com>

Added a 00DIALECTS file, containing UNIX dialect  
version numbers, that can be used by Configure and  
the man page.

#### 4.15 August 15, 1997

Aligned `Configure -help` output better. Removed  
Configure's 2.6 Beta test adjustments.

Added improved Solaris VxFS configuration and  
handling, based on information from Greg Earle  
<earle@netbsd4me.jpl.nasa.gov>.

Added socket state -- TCO or TPI -- for socket

files at the suggestion of Ian Fitchet  
<I.D.Fitchet@ftel.co.uk>.

#### 4.16 September 25, 1997

Added reporting of TCP/TPI queue lengths and window sizes ala netstat to NAME column. Added -T option to select or de-select TCP/TPI info reporting. (Window sizes are only reported for Solaris.)

Fixed anomalies along the way in SIZE/OFF processing for some dialects.

Fixed service name argument processor to allow minus signs as part of the name. Consequently this disallows names with embedded minus signs from being specified as the start of a range.

Added 00FAQ entries explaining why lsof won't find a file being edited with vi, why window sizes aren't reported for all dialects, and what the "no more information" message means.

Forced Pyramid CC to be /usr/ccs/bin/cc to avoid accidental use of the BSD variant in /usr/ucb/cc.

Added support for Linux glibc2, including a Configure test; cross-Configure support (00XCONFIG); and much unfortunate and risky sleight-of-hand in lsof Linux dialect header and source files, forced upon lsof by incompatibilities between Linux kernel and glibc2 header files.

Included in scripts/identd.perl5 a Perl 5 implementation of an identd server, using lsof, provided by Kapil Chowksey <kchowksey@hss.hns.com>.

Updated IRIX 6.4 xfs\_inode guess.

#### 4.17 October 14, 1997

Added -V option for verbose search result reporting. Verbose reports are prepared for failure to locate file names, command names, Internet addresses or files, login names, NFS files, PIDs, PGIDs, and UIDs.

Augmented Linux NFS file test to cope with kernels whose NFS code is in a loadable module. Need for the test was pointed out by Jonathan Sergent

<sergent@csociety.ecn.purdue.edu>. The change required that Linux have private dmnt.c source,

Completed a Linux 2.1.57 port on a system provided by Jonathan Sergent.

4.18 October 25, 1997

Eliminated memory leaks in alloc\_lfile(), lkup\_port(), and NEXTSTEP's process\_text() function.

Added recognition of OpenBSD 2.2 in Configure, supplied by Kenneth Stailey <kstailey@disclosure.com>.

Consolidated print\_file() functions to use the one in lib/prtf.c. Made it configurable and changed it to size print columns dynamically.

!!! WARNING !!!

WITH

DYNAMICALLY SIZED PRINT COLUMNS LSOF 4.18  
PRODUCES OUTPUT SIGNIFICANTLY DIFFERENT FROM THAT  
OF PREVIOUS REVISIONS. LINES ARE GENERALLY SHORTER  
AND THERE IS GENERALLY LESS BLANK SPACE BETWEEN  
COLUMNS AND THE ITEMS IN THEM. THERE ARE NO LONGER  
ANY SPACES BETWEEN DEVICE NUMBER ELEMENTS, ONLY  
COMMAS.

!!! WARNING !!!

Added special types and print specification modifiers for file size and offset to handle UNIX dialects with 64 bit sizes and offsets. Paul Eggert <eggert@twinsun.com> reported the need for this addition.

With Paul Eggert's help picked lint from the lsof library, the main level lsof sources, and the Sun dialect sources.

Added documentation, including the file 00LSOF-L, about the lsof-l LISTSERV.

Added support for Reliant UNIX on the RM600. Bob Passarella <rmpassar@pyramid.com> supplied the changes. Kevin Smith <kevin@pyramid.com> helped arrange test systems. While incorporating Bob's changes, modified lib/rnch.c to handle kernel

ncache

structs whose name is accessed via a char \*, rather than in a char array.

Changed #include order of <sys/socketvar.h> for Solaris 2.x. W. Richard Stevens <rstevens@kohala.com> pointed out the need to do this.

4.19 October 30, 1997

Changed Pyramid Reliant RM600 proc scan to skip SSYS (p\_flag) processes, since they don't seem to have a readable u\_cdir vnode.

Enabled Pyramid Reliant UNIX kread() work-around for DC/OSx, too, since its read(/dev/kmem) kernel driver seems to share the page boundary bug this work-around circumvents.

Changed SzOffFtm\_d and SzOffFtm\_dv (new formats at 4.18 to print size and offset) from signed to unsigned. Setting them signed at 4.18 was an oversight.

Plugged a memory leak that caused the loss of 130 bytes per repeat-mode pass. Fixed it with a simple work-around in main(). Lionel Cons <Lionel.Cons@cern.ch> reported the leak.

4.20 November 11, 1997

Tested under BSDI 3.1.

Added support for Reliant UNIX Mesh IPC files with help from Billy Ho <bho@pyramid.com>.

Added support to Digital UNIX lsof that uses the libmsfs tag\_to\_path() function (when it exists) to look up AdvFS path names. The idea and sample code came from Dean Brock <brock@cs.unca.edu>. Converted Dean's code into more general purpose support for private name cache lookups via the HASPRIVNMCACHE #define in the dialect machine.h file and code conditional on it in the printname() function.

Taught Digital UNIX lsof to recognize NFS3 file systems. Corrected Digital UNIX lsof DEVICE column alignment.



4.21 December 1, 1997

Squashed bug, introduced at revision 4.18, that resulted in double reporting of each selected PID when terse mode (-t) was specified.

Corrected minor bug, also introduced at 4.18, that might cause an extra print\_proc() pass when one PID has been specified.

Added -R to lsuf options in scripts/idrlogin.perl\*. The option should have been there -- it was supposed to be mandatory for PGID reporting -- but a bug, corrected in revision 4.18, previously made -R unnecessary.

Enabled configuring for BSDI BSD/OS 4.0 per a suggestion from Jeff Honig <jch@bsd.com>.

Enabled replacement of scoff\_t with off64\_t (scoff\_t is used to type r\_size and r\_localsize in the rnode struct) for IRIX 5.3 systems that have the NFS kernel rollup patch (1477). This compensates for SGI's failure to distribute an updated <sys/fs/rnode.h> with their patch.

Validated under Linux 2.0.3[12], Linux 2.1.64, and NetBSD 1.3.

Added FreeBSD root directory reporting, courtesy of Dan Nelson <dnelson@emsphone.com>.

4.22 December 15, 1997

Made adjustments for Linux 2.1.7[02].

Improved NAME information for Linux UNIX domain sockets.

Added option +|-M to control the reporting of portmapper registration information in square brackets after the TCP or UDP port or service name. Kenneth Stailey <kstailey@disclosure.com> suggested the feature and provided sample code from OpenBSD. Reporting is disabled by default in the distribution and may be enabled with +M; if lsuf is compiled with HASPMAPENABLED (e.g., from machine.h), reporting will be enabled by default and can be disabled with

-M.

Changed the -w option to +/-w to match the syntax of the +/-M option and to eliminate any options that flip meaning when a symbol is defined at compile time. For both +/-M and +/-w, specifying '-' when the default state is disabled or specifying '+' when the default state is enabled causes no problems.

!!!WARNING The -w option has changed in lsof 4.22. WARNING!!!

Made the +/- prefix legal for most options, but didn't document it in the man page or help panel. Most options that disable something -- e.g., -b, -C, -n, -P -- now disable when the prefix is '-' and enable when it is '+'. Since the states these options disable are enabled by default, I chose to avoid documentation complexity and confusion by not mentioning that they can be used with the '+' prefix.

Condensed the help panel.

Made sure Digital UNIX Configure stanza puts normal include path (e.g., /usr/include) before system include paths.

Added IPX socket information reporting to Linux with help from Jonathan Sergent <sergent@purdue.edu>.

4.23 January 16, 1998

Fixed conflict arising from the quondam replacement of the Sun Solaris <netdb.h> with a BIND/BSD version.

With help from Jonathan Sergent <sergent@purdue.edu> developed a /proc file system based Linux lsof. It needs some Linux 2.1.x release to work -- I'm not sure which, but I tested under 2.1.72, 2.1.76, and 2.1.79. The Configure script selects special sources for this lsof, so the full lsof distribution now contains both /dev/kmem and /proc based sources for Linux lsof. An optional kernel mod, written by Jonathan, enhances the /proc-based lsof ability to recognize IPX socket files. Reorganized and augmented

the Linux sections in 00FAQ to explain the two types of Linux lsof.

Defined DOSTAT\_FUNCTION for dostat() in misc.c to select the function, stat() or lstat(), it will use. DOSTAT\_FUNCTION is normally undefined, defaults to lstat(), and is only defined for the /proc-based Linux lsof in its dlsof.h.

Made conditional on the presence of IRIX 6.4 XFS rollup patch #6 an XFS node change introduced in revision 4.16. Identified the patch with help from John R. Vanderpool <fish@daacdev1.gsfc.nasa.gov>.

Added NFS node compensation for NetBSD 1.3. The code and suggestion for it was supplied by Jean-Luc Richier <richier@imag.fr>.

Added diagnostic messages to the /dev/kmem-based Linux Mksrc script to report errors during the construction of the kernel name cache header file, knccache.h. Added 00FAQ information on knccache.h.

Added a new Linux test host, running 2.0.33 and Glibc, provided by Steve Logue <stevel@mail.cdsnet.net>.

Ported to PTX 4.1.3 and 4.4.2. Adjusted lib/rnch.c for 4.4.2 to allow customization of additional ncache struct element names.

4.24 January 28, 1998

Changed /proc-based Linux lsof offset test to use "/" instead of "/etc/passwd".

To assist Jim Mintha <jim@geog.ubc.ca> with the packaging of lsof for Debian Linux, added a DEBIAN\_LINUX\_LSOF #define to trigger the activation of special system map file location code in the /dev/kmem-based dproc.c.

Applied modification to dialects/bsdi/dlsof.h from Ingimar Robertson <iar@skyrr.is>, enabling lsof to compile for BSDI BSD/OS 2.0.

Corrected a documentation error in 00DCACHE, pointed out by Thomas Anders <anders@hmi.de>. The error was created when the -V option was added at lsof 4.17.

Made IRIX 5.3 through 6.3 lsof aware of IRIX SCSI tape devices (e.g., /dev/tape). Dave Olson of SGI and Randolph J. Herber of FNAL provided valuable advice, and Igor Schein <ischein@air-boston.com> helped test.

Added a machine.h symbol (NEVER\_HASDCACHE) that prevents Customize from offering to change HASDCACHE. The symbol may appear anywhere in machine.h -- e.g., in a comment. Included the symbol in a comment of the HASDCACHE section of the /proc-based Linux lsof machine.h, and accompanied it with warnings against #define'ing HASDCACHE. Did the same thing for WARNDEVACCESS (NEVER\_WARNDEVACCESS is the suppressant.)

4.25 February 7, 1998

Corrected an IRIX mis-cast of file offset (position). Igor Schein <ischein@air-boston.com> reported the problem. This was offered as a patch to 4.24. Picked some lint Igor pointed out.

At Igor's suggestion added an optional decimal digit size argument to the -o option. This argument specifies how many file offset decimal digits can follow "0t" before lsof switches to a "0x..." form. The argument size specification doesn't count the two characters of the "0t". A size of 0 means unlimited. The default is OFFDECDIG (8), preserving compatibility with existing lsof output; it can be changed by the lsof builder. When size is specified with -o it does not force offset display; -o without a size still must be used to do that.

Added an IRIX 6.2, 32 bit system, XFS node patch, courtesy of Ulrich Bernhard <rzubu@rzu.unizh.ch>.

For my own convenience enabled Configure to use /usr/local/bin/gcc for NEXTSTEP. This allows circumvention of a gcc 2.8.0 ranlib problem on my test 3.1 `040 cube.

Added flags recommended by the RISC/os and Ultrix compilers for the updated (and longer) main.c.

Updated FreeBSD cd9660\_node.h Configure test.

4.26 February 17, 1998

Added shared process group processing for IRIX 5.3, and IRIX 6.1 and above, based on investigation of a bug report from Igor Schein <ischein@air-boston.com>. Igor helped test this addition.

Improved handling of file system name arguments. It's now done in a manner similar to fuser. The -f argument forces path names to be considered as simple files, rather than as file system names.

The +f flag forces them to be considered as file system names. Normally path arguments are considered file system names when they match a mounted-on directory in the system's mount table, or when they match a mounted file system's block device. Igor Schein helped test this change.

Igor also suggests that the proper compilation of the IRIX 6.4 proc structure after patch 2536 has been installed may need -DPIOMEMOPS. So lsof's MkKernOpts script was updated to propagate that option from CCOPTS in /var/sysgen/system/irix.sm, even though patch 2536 doesn't add -DPIOMEMOPS to it. Added a 00FAQ item on this patch.

Added a fatal warning message about names forced to be file system names (with +f) that have no match in the mount table.

Improved the -V message for files and file systems for which no open files were found. Added reporting of /proc file and file system search failures.

Did some code reorganization to combine the multiple ck\_file\_arg() functions into one. Moved the new function from the library to the top level and put it in arg.c; moved the usage function from arg.c to a new top-level source file, usage.c, to balance top-level source file size. The new usage.c depends on version.h; arg.c no longer does.

Added flag recommended by the DU compiler for the updated (and longer) main.c.

4.27 March 6, 1998

At the request of Igor Schein <ischein@air-boston.com> added a conditional repeat mode option, using the '+' prefix to the 'r' option. '+r' operates as does '-r' with the exception that it exits the first time no open files have been listed during a cycle. The exit code will be zero when any open files have been listed; one, if none were ever listed.

Ported lsof to HP-UX 11.0 with the help of Richard Allen. This port hasn't been tested on a 64 bit kernel; I'm sure it won't work there without more mods. It may not work on PA 2 architectures; I've only tested it under PA 1 and a separate, busy tester reported PA 2 problems that I've been unable to investigate.

In anticipation of getting access to a 64 bit HP-UX kernel and the pending start of the Solaris 2.7 Beta test (It will have 64 bit kernel addressing.), started adding support for 64 bit kernel pointers. This includes: ubiquitous use of the KA\_T cast for kernel pointers; a format to print them, KA\_T\_FMT\_X; a function to print them, print\_kptr(); and modifications to most kernel-related functions -- e.g., process\_file(), process\_node(), process\_socket(), readvfs() -- to process kernel addresses as KA\_T types.

Fixed minor bug in handling path name arguments that end with a '/'.

Removed support for RISC/os; its test system is no longer available.

Made modifications to insure that lsof output doesn't contain non-printable characters. All such characters are now printed in the printf form "\x%02x". Several new common functions were installed in misc.c to support "safe" printing. This second major modification in 4.27 to common and dialect code could have introduced bugs not yet detected.

4.28 March 10, 1998

Refined unprintable format to use \b, \f, \r, \n,

\t, and ^\* (for CTRL) forms. Corrected omission of safestrprt() use for field output command name. These changes were offered as patches to 4.27.

Made space an unprintable character (\x20) in the COMMAND column; printable elsewhere, including the NAME column, field output, and error messages.

Made sure FD column is parseable as a single entity -- i.e., has no embedded space. Thus, if the access mode is unknown but there is a known lock mode, (a very rare case) the access mode will be printed as `-'.

Picked lint with gcc 2.8.0 under Solaris 2.6.

With the help of Dave Olson of SGI identified a proc struct element that should have been added to <sys/proc.h> by IRIX 6.4 patch 2536. Added a work-around for it to the lsof Configure script.

Igor Schein <ischein@air-boston.com> identified that the patch caused a proc structure length complaint from lsof. Removed an obsolete 00FAQ item on the patch, installed at lsof 4.26, explaining that no solution was yet available.

Added a 00FAQ item on how BIND installs its own header files, including <netdb.h>, which may cause the rpercent struct definition to vanish. Solaris has an automatic lsof work-around, but that hasn't been (and probably can't be) propagated to all dialects supported by lsof. The 00FAQ item recommends re-installation of the vendor header files that BIND has replaced. (Others include <rpercent.h>, <sys/bitypes.h>, and <sys/ctypes.h>.)

Made AIX AFS fixes.

4.29 March 26, 1998

Corrected bug in Internet address matching. The matching formerly stopped if the foreign address matched, thus failing to check the local address for a match. That led to a possible false "Internet address

not located" warning (i.e., in response to -V) about the local address, when both foreign and local addresses were specified with -i. This

correction was offered as a patch to 4.28.

Changed readmnt() usage in an attempt to defer mount readlink() and stat() delays until they are necessary.

Corrected two bugs in the Digital UNIX readdev() function. Made the correction available as a patch to 4.28 and regenerated the 4.28 DU binaries.

Added a missing argument to a print-kptr() call in the HP-UX dsock.c. The missing argument causes a fatal gcc error. The problem was reported by Eyal Shaynis <eyal.shaynis@telrad.co.il>. The fix was offered as a 4.28 patch.

Adjusted for Digital UNIX 4.0D; the spec\_node structure is now defined in <sys/specdev.h>. Kris Chandrasekhar <Kris.Chandrasekhar@digital.com> identified the need for the adjustment.

Incorporated a bug fix from Brian McAllister <mcallister@mit.edu> to the DU readmnt() function. This fix was offered as a patch to 4.28.

Added "safe" printing to a SunOS clone device error message.

Corrected bug in tabling of Linux /proc-based lock info.

Corrected bug in handling of SunOS TLI streams. Dan Farmer <zen@trouble.org> reported the problem.

Added a Solaris 2.6 work-around to keep the BIND <sys/bitypes.h> from colliding with the Solaris <sys/int\_types.h>.

Strengthened the Configure test for /proc-based Linux lsof, based on a report from Marty Leisner <leisner@sdsp.mc.xerox.com>.

Tested on OpenBSD 2.3.

Made AIX changes that allow use with 3.2.5. The changes were suggested and tested by Brett Hogden <hogden@rge.com>.



Added Solaris 2.6 AFS support. Disabled reporting of some node numbers for Solaris 2.5 and above open AFS files. The node number computation algorithms used for SunOS 4.1.x and Solaris less than 2.5 no longer always work under Solaris 2.5 and above.

4.30 April 9, 1998

Corrected a pid structure member naming error for

UnixWare < 2.1.2. The problem was reported by Richard van Meurs <vanmeurs.anva@atriserv.nl>. He supplied the correction. This was offered as a patch to 4.29.

Had a report from Igor Schein <ischein@air-boston.com> that IRIX 6.4 patch 2839 is another SGI kernel patch, along with 2536, that changes the size of the proc structure in the kernel without changing the proc structure in <sys/proc.h>. Upon further investigation found that the effect of these patches on the proc structure is not consistent. Therefore, dropped the Configure patch test for IRIX 6.4 and made the code in irix/dproc.c slightly more tolerant of proc structure size differences for IRIX 6.4. Igor help test the change.

Corrected Solaris >= 2.5 AFS inode number generation. Craig Everhart <Craig\_Everhart@transarc.com> helped find the cause of the problem. This was offered as a patch to 4.29.

Refined the Linux /dev/kmem-based glibc evasion for the timeval structure to make it work with glibc version 2.0.7. This required defining a new global symbol, TIMEVAL\_LSOF, default timeval, that the /dev/kmem-based Linux lsof can set to its private glibc timeval name, distinct from the kernel timeval name.

Added support for Alpha to the /dev/kmem-based Linux lsof. Alexandre Oliva <oliva@dcc.unicamp.br> provided a test system. Added an item to 00FAQ about lsof, the Alpha processor, and Linux.

Added a 00FAQ item about lsof year 2000 compliance. Basically it says lsof is probably compliant,

because its only date or time computations are done with time\_t values, but I haven't done any specific Y2K validation. I don't have plans to do any.

Added support for UnixWare 7. Chris Daniels <chrisd@dlpco.com> provided a test system and Don Draper <dond@sco.COM> provided technical information. Added BFS and SFS file system support to lsof for UW 2.1.[12] and 7.

Updated Solaris VxFS support for VxFS 3.2.1. Greg Earle <earle@netbsd4me.jpl.nasa.gov> reported the need for the update. Greg and Roger Klorese <rogerk@veritas.com> provided technical information. Scott McClung <mcclung@primenet.com> tested.

Changed IRIX XFS patch detection in anticipation of learning there are multiple XFS patches for IRIX 6.4 that require different versions of the lsof-invented xfs\_inode structure.

#### 4.31 April 21, 1998

Added a VxFS #if/#endif wrap to a section of the HP-UX dnode.c that wasn't properly protected. The problem was reported by Peter Klosky <PKlosky@bdm.com>. This was offered as a patch to 4.30.

Added support for Solaris 2.7 (first Beta release). Mike Sullivan <Mike.Sullivan@Eng.Sun.COM> provided technical advice and helped test. Charles Stephens <cfs@jurassic.eng.Sun.COM> also helped test.

Fixed bug in /proc-based Linux that caused it to access /proc/mounts excessively. Marty Leisner <leisner@sdsp.mc.xerox.com> provided a syscall trace that identified the bug.

The fix was offered as a patch to 4.30.

Adjusted the IRIX 6.4 private structure definition for the XFS node to accommodate patch 2970. Igor Schein <ischein@air-boston.com> identified the patch and the required adjustment.

#### 4.32 May 11, 1998

Corrected Solaris 2.7 code for reporting PCFS (floppy disk) node numbers. Casper Dik

<casper@holland.sun.com> supplied the fix. The fix was offered as a patch to 4.31.

Corrected a bug in conditional repeat mode handling pointed out by Igor Schein <ischein@air-boston.com>. This was offered as a patch to 4.31.

Improved reporting of AIX open(/dev/memory device) errors.

Corrected a Solaris < 2.5 KA\_T declaration error, pointed out by Robert Kiessling <robert@easynet.de>. Changed KA\_T from a #define to a typedef for all dialects to prevent future problems of this kind.

Changed the sample Perl 5 script big\_brother.perl5 to report a four digit year from localtime().

Added support for AIX 4.3[.1]. Bill Pemberton <wfp5p@tigger.itc.virginia.edu> provided a test system. Andrew Kephart <akephart@austin.ibm.com> and Tom Weaver <tvweaver@austin.ibm.com> provided technical assistance. Niklas Edmundsson <nikke@ing.umu.se> did 4.3.1 testing.

Added -qmaxmem option to CFLAGS for an AIX compilation with an xlc version 4.x compiler.

Adjusted Linux socket handling for changes in the AX25 members of the sock struct. Richard Green <rtg@tir.com> pointed out the problem. Tested /dev/kmem-based lsof under Linux 2.0.34.

#### 4.33 May 22, 1998

Added generic IPv6 support to common lsof sources and specific IPv6 support to AIX sources. Andrew Kephart <akephart@austin.ibm.com> supplied the additions and helped with testing. Bill Pemberton <wfp5p@tigger.itc.virginia.edu> provided a test system. The modification affected sources for every dialect, whether it supports IPv6 or not, by changing the interfaces to the common Internet address function ent\_inaddr().

Added support for the NetBSD UVM virtual memory system. Paul Kranenburg <pk@cs.few.eur.nl> supplied

technical details.

Bracketed HP-UX 11 use of `<sys/spinlock.h>` with `#if/#endif _KERNEL`.

Corrected printing of PCB address in DEVICE column for IRIX.

#### 4.34 June 26, 1998

Updated 00FAQ to discuss TCP and UDP ports private to the AIX kernel and 00README to describe how ACLs can be used to give lsof permission to read the kernel memory devices. Add information to 00FAQ and 00README about other OpenBSD architectures where lsof is reported to compile and run. Added section to 00FAQ discussing how an incorrect loader path environment variable value can prevent lsof from loading correctly.

Improved Solaris namefs and doorfs support so that it is now possible to search for an open VDOOR file by the path name of its fattached file system object. Igor Schein `<igor@txc.com>` requested the ability to do such a search. Even with the change, lsof can't always identify path names for open VDOOR files.

Also at Igor's request, improved reporting of information on open Solaris VCHR files that share a common vnode, and Solaris UNIX domain socket files.

Corrected `print_kptr()` argument error in PTX `dnode.c`, reported by Mark Price `<mprice@sequent.com>`. Compensated for ncache element naming differences, introduced at PTX 4.4.2; Kurtis D. Rader `<krader@sequent.com>` reported the problem.

Changed output column title from INODE to NODE to better reflect the column's contents of node IDs for more than just inodes.

Improved Configuration and processing for Solaris AFS. Corrected AIX AFS 3.4 `afs_rwlock_t` simulation.

Corrected a cast problem with two AIX `knlist()` calls, thus quieting an AIX 4.2.1 compiler argument

type warning. Jon Champlin <champlin@us.ibm.com> reported the problem.

Added support to most dialect versions (exception: /proc-based Linux) to warn when the identity of the kernel where lsof was compiled doesn't match the running identity. The warning can be suppressed with -w. Note: determining AIX state requires calling oslevel, a potentially slow operation. Jon Champlin <champlin@us.ibm.com> suggested this addition.

!!!! WARNING !!!!   !!!! WARNING !!!!   !!!! WARNING !!!!

Those using the lsof cross-configuration capability (see 00XCONFIG), should be aware that the kernel identity test feature introduces two new basic cross configuration environment variables, LSOF\_ARCH and LSOF\_VSTR.

!!!! WARNING !!!!   !!!! WARNING !!!!   !!!! WARNING !!!!

Identified a situation where a Solaris UNIX domain socket name is known and can be searched for by name; added the necessary code.

4.35 July 17, 1998

Made the kernel identity check an option with the HASKERNIDCK #define in machine.h. Enabled altering of HASKERNIDCK with the Customize script. Added a clause to the help output that indicates the build-time HASKERNIDCK status.

Added more information to the NAME column for Solaris UNIX domain sockets. Made them searchable by their clone device path name. Igor Schein <igor@txc.com> requested this.

Completed the HP-UX 11 port with support for its optional 64 bit kernel. Rich Rauenzahn <rrouenza@cup.hp.com> provided a test system. Corrected errors with HP-UX 11 lock reporting and private kernel structure and type definitions. Added support for HP-UX NFS3 files.

Limited mount table warnings -- e.g., when -b is

used -- to one set per mount point.

Fixed some mount table scanning and usage bugs, including one in Solaris, reported by Kjetil Torgrim Homme <kjetilho@ifi.uio.no>.

#### 4.36 August 4, 1998

Made corrections and additions to IPv6 support and to AF\_ROUTE socket handling, supplied by Jean-Luc Richier <Jean-Luc.Richier@imag.fr>. Jean-Luc's additions provide IPv6 support for the Inria IPv6 implementations on FreeBSD and NetBSD.

Fixed two Solaris 2.5, 2.5.1, 2.6 and 2.7

TCP and

UDP host name or IP address reporting bugs, reported by James Mathiesen <James-Mathiesen@deshaw.com>. This fix was offered as a patch to 4.35.

Updated the Customize script to cause ENTER to use all defaults. Amir J. Katz <amir@ndsoft.com> suggested this and helped test the changes.

Updated Solaris ICMP and IP stream handling, based on a report from Igor Schein <igor@txc.com>.

Fixed a bug in the Digital UNIX mount table handling, reported by Bob Ward <bward@thehartford.com>. While working on the bug, found and updated some obsolete AdvFS code. This fix was offered as a patch to 4.35.

#### 4.37 September 15, 1998

Deactivated SGI IRIX support and archived revision 4.36 sources and binaries in pub/tools/unix/lsof/OLD.

Improved performance of FD searching. This was offered as a patch to 4.36.

Amir J. Katz <amir@ndsoft.com> pointed out that ranlib isn't needed for AIX or Solaris. Made appropriate Configure script changes.

Fixed a file

offset reporting bug for HP-UX VCHR and VBLK device nodes located on a VxFS root. Doug Siebert <douglas-siebert@iowa.edu> reported the bug. The fix was offered as a patch to 4.36.

Resolved an HP-UX root device name reporting bug, partly caused by an out-dated local copy of the <sys/mount.h> mount structure, by generating a local header file with the structure that can be compiled without needing \_KERNEL defined. Doug Siebert also reported this bug.

Changed some dialect source code -- Digital UNIX, Solaris, SunOS, and UnixWare -- to make more consistent with ps the user ID lsof reports in the USER column. Added a FAQ entry about it. Igor Schein <igor@txc.com> reported the Solaris and SunOS lsof inconsistencies with what ps(1) reports.

Ported lsof to Pyramid ReliantUNIX 5.44.

Added brackets as comments to case, do, done, else, endif, esac, if, and while statements in Configure to assist in navigating its clauses.

Added more Linux 2.0.x glibc work-arounds.

Added support for UnixWare 7.0.1.

Ralph Forsythe <ralph@contact-paging.com> provided a new FreeBSD test system.

4.38 November 25, 1998

Added support for recent FreeBSD 3.0 distributions. A 3.0 test system was provided by David O'Brien <obrien@NUXI.com>. This was offered as a patch to 4.37.

Updated the scripts/idrlogin.perl\* files to look for sshd processes in addition to rlogind and telnetd ones.

Added support for DU 5.0 Beta. Berkley Shands <berkley@cs.wustl.edu> provided a test system.

Added support for OpenBSD 2.4 with changes supplied by Kenneth Stailey <kstailey@disclosure.com>.

Changed the Solaris 2.7 tests and documentation to Solaris 7.

Made some changes to the header files for NEXTSTEP 3.3 and added support for OPENSTEP 4.x with help from Michael A. Hovan III <mhovan@BLaCKSMITH.com> and Carl Lindberg <Carl\_Lindberg@BLaCKSMITH.com>. The combined dialect subdirectory is named n+os. One of Carl's changes propagates RC\_CFLAGS to the library Makefile. Timothy J. Luoma <luomat@peak.org> helped test under NEXTSTEP 3.3 and OPENSTEP 4.2.

Made UW 7.x version sensitive to the presence of ptf7038. Added peer PCB address to Unix domain socket Name column, even when a path name has been located. Information for these changes was supplied by Francis Le Bourse <flebourse@intelcom.fr>. Lee Penn <lee@dlpco.com> provided a test system.

Tested lsof under OSR 5.0.5 on a test system also provided by Lee Penn.

Made path name argument processing more tolerant of errors per a suggestion from Julian Gordon <julian@cadence.com>.

Acquired a new UnixWare 2.x test system, generously provided by Computer Classroom, Inc. -- Matthew Thurmaier <matt@compclass.com>, Ken Laing <ken@compclass.com>, and Andrew Merrill <andrew@compclass.com>. Updated Configure to accept a UnixWare version of 2.1.3.

Updated kmem-based lsof for Linux 2.0.36.

Updated NetBSD sources for a change in a UVM virtual mapping header file.

Corrected a cache allocation bug in Sun format kernel name cache handling. The bug only shows up when the kernel name cache is inaccessible.

4.39 December 29, 1998

Corrected problems with large device number handling for 64 bit Solaris 7. The problems were reported by Steve Bellenot <bellenot@math.fsu.edu>. Steve helped test the fixes. The fixes were offered as two patches to lsof 4.38.



Improved FreeBSD Configure operations for header files that must be obtained from the kernel source tree, based on a suggestion from David O'Brien <obrien@NUXI.com>.

For Bela Lubkin <filbo@deepthought.armory.com> made optional with +f[cfn] the display of file structure address, shared use count, and node structure address. /proc-based Linux doesn't implement this feature, because it doesn't read kernel structures from kernel memory. Modified the PTX -X option to take advantage of the new file structure display option.

Added shared.perl5 to the scripts/ subdirectory to provide an example of how +f[fn] might be used to track shared file descriptors and files.

Added more /dev/kmem-based Linux glibc evasions, provided by Jeff Johnson <jbj@redhat.com> and Maciej Lesniewski <nimir@kis.p.lodz.pl>. Jeff helped test them on various Linux architectures.

Tested on AIX 4.3.2; no changes were required. Doug Crabill <dgc@purdue.edu> provided a test system.

Fixed -c option to detect missing command name when following option begins with `+'.

4.40 January 25, 1999

Added support for using the CDS compiler for Reliant Unix 5.44 and above. Made Reliant Unix MIPC support optional, dependent on the presence of <sys/mipc.h>.

Based on a report from Michael Schmitz <MSchmitz@lbl.gov> that /dev/kmem-based lsof misbehaves on a Linux 2.0.x m68k kernel without module support, made the absence of query\_module() or get\_kernel\_syms() Linux kernel support a fatal error.

Updated relevant sections of 00FAQ to reflect the change.

Added the ability to force the Linux Configure stanza to use the /proc or /dev/kmem source base via a LINUX\_BASE environment variable specification. This is a cross-configuration assist.

Added "+D <dir>" and "+d <dir>" options for directory searching. +D searches the entire tree, starting at <dir>, including <dir>, its contents, and its subdirectory branches; +d searches only <dir> and its contents, but not its subdirectory branches. Improved lsof's searching of the specified name list to compensate for anticipated long lists from +d and +D.

Made an egrep in the Solaris Configure stanza usable by the standard and XPG4 egrep's. Kenneth Stailey <kstailey@disclosure.com> pointed out the improvement.

Fixed bugs in /dev/kmem-based Linux and UnixWare Unix domain socket name searching.

Changed a Linux Alpha #include to be conditional on the presence of its named header file, so that lsof will compile on Red Hat 5.1 and 5.2 (Linux kernel 2.0.35) where the header file is absent. The problem was reported by Alexandre Oliva <oliva@dcc.unicamp.br>.

Fixed an AIX 4.3+ bug in procinfo struct space allocation, reported by Jeff Stewart <jws@purdue.edu>. This was offered as a patch to 4.39.

Added an lstatsafely() function to offer the same isolation for lstat() calls that statsafely() offers for stat() calls. This made DOSTAT\_FUNCTION no longer necessary, so deleted it.

With help from Laurent P. Montaron <lpm@sequent.com> ported lsof to PTX 4.4.4. Laurent did a monumental job of identifying TCP/IP changes by their TCP version, rather than by their PTX (With mix 'n match PTX and TCP/IP versions, the PTX version often has no bearing on the TCP/IP version.), and changed the Configure script and pre-processor #if/#else/#endif blocks to match. He also updated Unix domain socket handling for PTX TCP/IP versions 4.5 and above.

Updated CLIENT handle acquisition of fill\_portmap() in print.c to use the more modern RPC function clnt\_create() in place of clnttcp\_create() where

possible. PTX 4.4.4 requires `clnt_create()`.

4.41 February 27, 1999

Added FreeBSD 3.1 and 4.0 support with help from Sheldon Hearn <axl@iafrica.com>, David O'Brien <obrien@NUXI.com>, and John Polstra <jdp@polstra.com>.

Corrected bungled AIX 4.3+ patch that went into `lsf` 4.40.

Reorganized the `Configure` script to improve `Makefile` construction. A specific impetus for this was to allow FreeBSD system-wide make flags to be propagated to the `lsf` `Makefiles`, but other goals were to make sure that the `DEBUG=` make entry can over-ride standard `CFLAGS` values, and to better manage the identification of compilers and their versions. Two compiler-related values may now be supplied in environment variables: 1) the compiler path in `LSOF_CC`; and 2) the compiler version in `LSOF_CCV`. `00XCONFIG` documents them.

Added support for Pyramid Reliant Unix `bsdfs`, `msockfs`, and `sockfs` file systems.

Added an optional `LSOF_CINFO` string to `Configure`, producing a `CINFO` string in selected `Makefiles`, producing a `#define LSOF_CINFO` in selected `version.h` header files. The purpose of this is to allow `Configure` the option to propagate information to the `lsf -v` output. It is now used for Linux to identify the code base, and for HP-UX 10.30 and 11.0 and Solaris 7 to identify the kernel bit size.

Added system information to `NEXTSTEP` and `OPENSTEP` `-v` output, from the second line of `hostinfo`'s output.

Fixed a login name buffer overflow problem in the processing of `-u` option values. This was offered as a patch to 4.40. **!!!THIS IS A SERIOUS STACK OVERFLOW BUG; A LINUX EXPLOIT EXISTS FOR IT THAT OPENS A BASH SHELL WITH LSOF'S AUTHORITY -- E.G, SETGID(KMEM) POWER!!!**

Improved the Solaris mount table filter so the volume manager's fake mount point, `"/vol"`, is

ignored and doesn't supplant  
"/" in NAME column  
path assemblies. Igor Schein <igor@txc.com> reported  
this bug and provided important help in finding  
it. This was offered as a patch to 4.40.

Changed the Linux /dev/kmem-based lock ownership  
test to answer a problem reported by Tom Christiansen  
<tchrist@jhereg.perl.com>. This was offered as a  
patch to 4.40.

Installed an HP-UX 11 patch, suggested by Kevin  
Vajk <kvajk@cup.hp.com>, that adjusts a private  
lsof kernel header file, derived via Q4, to correspond  
to an HP-UX patch bundle.

Made NetBSD 1.3I sockproto structure adjustment.

4.42 March 30, 1999

Fixed a typo in the HP-UX dfile.c that caused +fF  
and +fN output controls to swap effect.

Enabled for OpenBSD 2.5 per notice from Kenneth  
Stailey <kstailey@kstailey.tzo.com>

Made more VM accommodations for FreeBSD 4.0.

Improved file system search reporting to include  
path name components when they're available, instead  
of mindlessly reporting the file system name in  
the  
NAME column. Guy Dallaire <gdallair@geocities.com>  
brought the need for this change to my attention.

Updated Solaris 2.6 VxFS for Veritas Oracle Database  
Edition 2.0, VxFS version 3.3, and VxVm version  
2.5.4, based on a report from Chris Kordish  
<chris.kordish@East.Sun.COM>. Chris kindly provided  
a test system.

Improved HP-UX ipc\_s patch detection in Configure,  
response in ../dialects/hpux/hpux11/ipc\_s.h, and  
documentation in 00FAQ, Kevin Vajk <kvajk@cup.hp.com>  
helped test.

Added to Customize the option to suppress HASKERNIDCK  
selection for specified dialects. Suppressed it  
for /proc-based Linux lsof, and removed its test

and code from there. Tin Le <tin@netimages.com> alerted me to the need for this update.

Ported to official Digital UNIX 5.0 release.

Changed DU lsof to use the knlist(3) function when no kernel file has been specified with -k. This change was suggested by Erich Wimmer <Erich.Wimmer@digital.com>.

Updated Configure for latest NetBSD (1.3I?) with UVM support the default.

4.43 May 11, 1999

Corrected a typo in the Solaris gcc discussion in 00FAQ. Made changes to the Solaris 2.5[.1] private tcp\_s structure. Both changes were done in response to reports from Igor Schein <igor@txc.com>, who tested the Solaris 2.5 change.

Made more IPv6 adjustments to lsof for Tru64 UNIX (Digital UNIX) 5.0, based on information obtained from Compaq by Berkley Shands <berkley@cs.wustl.edu>.

Corrected HP-UX error message about HP-UX 11 q4 usage. Amir Katz <amir@ndsoft.com> reported the correction.

Fixed a Glibc 2.1 conflict in /proc-based Linux lsof.

Fixed a man page typo reported by Vlad Harchev <hvv@hippo.ru>.

Changed some Solaris 2.7 references to Solaris 7 in Configure and 00EXPORTING.

Added a Solaris example to the echo statements that are the install rule in the SunOS/Solaris Makefile.

Added a field to the file structure output -- FILE-FLAG (file structure open flags, f\_flag[s], and process file flags, typically u\_pofile) -- enabled with +f[gG]. Its field output character is 'G'.

Figured out another piece of the HP-UX 11 patched ipc\_s structure puzzle with the help of Keith Kalet

<KEITH\_KALET@HP-USA-om41.om.hp.com>.

Fixed a PTX real vnode to real inode interpretation bug.

Added link count to lsof output. Eric Dumazet <dumazet@risgw.ris.fr> requested and helped test it. The new +L option enables and filters it. Its field output character is `k'.

Updated Configure script to recognize NetBSD 1.4.

Updated AFSCONFIG to handle default answers to questions.

Incorporated patch from Jonathan Sergent <sergent@io.com> that enables /proc-based Linux lsof to run on both 32 and 64 bit kernels.

Updated Configure script with a patch from David O'Brien <obrien@NUXI.com> that recognizes FreeBSD 3.2.

#### 4.44 June 24, 1999

Corrected use of nlink member of hsnodet for SunOS 4.1.x High Sierra File System files.

John Dzuber

<zube@tlaloc.stat.colostate.edu> reported the problem and helped test the fix. Also fixed a SunOS segmentation fault bug. These fixes were offered as a patch to 4.43.

Improved handling of /proc-based Linux UNIX PCB address.

Fixed a NEXTSTEP and OPENSTEP bug that made repeat option (-r) processing malfunction. This fix was offered as a patch to 4.43.

Fixed Configure so it doesn't use -O in the Cflags for the bundled HP-UX C compiler. Jim Ankenbrandt <jankenbrandt@penton.com> reported the problem.

Corrected output ordering of parent PID and process group ID when both -R and -g are specified.

Enhanced the pdev.c and pdvn.c library modules for wider use. These dialect versions use the new library modules: DEC OSF/1, Digital UNIX, and Tru64

UNIX; Pyramid DC/OSx and Reliant UNIX; SCO OSR and UnixWare; and Sequent PTX.

Added basic clone device support to /dev/kmem-based HP-UX lsof for HP-UX 10.30 and higher.

Added raw socket support to /proc-based Linux lsof.

Changed NODE-ADDR column title to NODE-ID in anticipation of using more general identification information in the column.

Ported to UnixWare 7.1, using a test system kindly provided by Matt Thurmaier <matt@compclass.com> and Don Draper <dond@sco.com>.

Updated for NetBSD 1.4C VM changes, and a new current and root working directory structure.

Made minor adjustment for latest Tru64 UNIX 5.0 Beta release.

#### 4.45 July 30, 1999

Fixed quoting problem in DEC OSF/1, Digital Unix, and Tru64 UNIX Makefile's install rule. The problem was reported by Berkley Shands <berkley@cs.wustl.edu>. Fixed bug in Tru64 UNIX 4 lsof that caused FDs to be skipped. These fixes were offered in a patch to 4.44.

Fixed a repeat-mode /proc-based Linux lsof bug, reported by Sami Farin <sfarin@ratol.fi>. This was offered as a patch to 4.44.

Picked lint, some reported by Sami Farin.

Corrected a 00DCACHE documentation error in a sample shell script. The problem was reported by Chad R. Larson <chad@larsons.org>. Changed commented-out entries in machine.h files so they require more thought and work when the comments are removed, based on a remark by Chad.

Compensated for the practice of Solaris 7 and above to record the dev= value in /etc/mnttab in 32 bit mode, even on 64 bit systems. This was offered as

a patch to 4.44.

Added a C library test for /proc-based Linux lsof, so that the #include files can be adjusted for a non-Glibc environment. The need for this was reported by Andrew Hill <andrewh@tirin.openworld.co.uk>. This was offered as a patch to 4.44.

Added support for Auspex LFS 1.8.1 and 1.9.2 to SunOS 4.1.4 lsof. The support was requested by Quentin Fennessy <quentin@dvorak.amd.com>, who provided information and did testing.

Enabled IPv6 support code for NetBSD and OpenBSD, conditional on Configure script tests. Wolfgang Rupprecht <wolfgang@wsrcc.com> supplied the NetBSD code and tested it. The OpenBSD code I constructed has been compiled but not tested.

Updated the identd Perl 5 script, based on a report from Wendy Lin <af5@taiyang.cc.purdue.edu> that the space in its response line in front of the user name violates RFC 1413.

Added IPv6 support to /proc-based Linux lsof. Jonathan Sergent <sergent@ETLA.NET> and Andrew Thomas Sydelko <sydelko@ecn.purdue.edu> kindly provided a test system.

Updated man page description of AIX multiplexed files to indicate that they might be /dev/ptc or /dev/pts, depending on the AIX version. The correction was suggested by Onno van der Linden <onno@simplex.nl>.

Sylvain Robitaille <syl@alcor.concordia.ca> reports lsof passes his Y2K tests.

4.46 October 23, 1999

Corrected /proc-based Linux lsof to detect that an IPv6 address is a mapped IPv4 address. The problem was reported and analyzed by Arkadiusz Miskiewicz <misiek@misiek.eu.org>, who also tested the fix.

Added a libc5 library /dev/kmem-based Linux lsof circumvention, supplied by Jason Lingohr



<lingman@lucid.net.au>.

Corrected a bug in -t (terse) AIX output, reported by Wendy Lin <af5@taiyang.cc.purdue.edu>. I introduced the bug at revision 4.43 when adding FILE\_FLAG reporting. This was offered as a patch to 4.45.

Added a work-around for a problem in the OpenBSD 2.3 <sys/pipe.h> header file. Volker Borchert <bt@tekonon.de> provided and tested it.

Improved description of cross-building lsof for a 64 bit Solaris 7 system on a 32 bit system with suggestions from Phillip Edwards <Philip.Edwards@sn.wpafb.af.mil>.

Fixed a gawk POSIX-mode pattern error in the Linux /dev/kmem-based Mksrc script, based on a tip from Ambrose C. Li <acli@mingpaoxpress.com>.

Fixed a bug in the Tru64 UNIX IPv6 handling, courtesy of a report from Casper Dik <casper@holland.sun.com>.

Enabled support for OpenBSD 2.6.

Enabled support for BSDI BSD/OS 4.1, based on a report from Jeffrey C Honig <jch@bsd.com> that only a Configure script change is necessary.

Enabled Configure script to use gcc for building lsof for a 64 bit Solaris 7 and 8 kernels, if the gcc version is 2.95 or above.

Improved -i option handling for systems with IPv6 support so that it will search for a host name in both IPv4 and IPv6 families, when that is possible. As a companion modification, changed -V processing to report a single error when a multiple host name match is requested. Casper Dik <casper@holland.Sun.COM> helped test.

Fixed a DEC OSF/1, Digital UNIX, Tru64 UNIX repeat mode bug, reported by Mayer Ilovitz <mayer@cooper.edu>. Mayer helped test the fix. The fix was offered as a patch to 4.45.

Changed Solaris socket file recognition scheme, so it is (nearly) the same through Solaris 8, where the previous clone device scheme no longer works.

With significant assistance from Casper Dik, added support for Solaris 8 Beta and Beta refresh. The IPv6 support in Solaris 8 is still in some flux, so there are temporary compensations for the differences between Beta IPv6 support and Beta refresh IPv6 support. Casper and I hope those differences disappear by FCS.

Improved the delivery of information on Solaris 2.5.1, 2.6, 7, and 8 door files.

Fixed a repeat mode bug that surfaces when /etc/passwd changes between cycles. The bug report and diagnostic help were supplied by Igor Schein <igor@txc.com>. The fix was offered as a patch to 4.45.

Added support for INRIA IPv6 to NetBSD. Jean-Luc Richier <Jean-Luc.Richier@imag.fr> provided patches and a test system on which to verify them.

Added support for AIX 4.3.3. Jeff W. Stewart <jws@anaconda.cc.purdue.edu> provided a test system.

Made adjustments for FreeBSD 4.0-current.

Improved reporting of information for AIX sockets that lack protocol control blocks.

4.47 November 29, 1999

Based on a query from Jean-Pierre Radley <jpr@jpr.com>, changed the lsof top-level Makefile to propagate CFGF to the library Makefile. (DEBUG was already being propagated.) Added osrgcc and scogcc Configure abbreviations (to use gcc) for Jean-Pierre.

In response to a query from Igor Schein <igor@txc.com>, improved the Configure script test for Solaris 7 and 8 that decides if the compiler can produce 64 bit executables.

Made an ugly hack, based on making a private rnode structure definition from q4 output, to compensate

for HP-UX 10.20 and lower recent NFS3 patches. HP didn't supply an updated <nfs/rnode.h> with the patches. The problem was reported by Will Partain <partain@mekb2.sps.mot.com>. Elias Halldor Agustsson <elias@hi.is> helped identify the patches as PHNE\_18173, PHNE\_19426, PHNE\_19937, and PHNE\_20091, and provided a test system.

Switched BSDI test system from 2.1 and 3.1 to 4.0.1, courtesy of Terry Kennedy <terry@tmk.com>.

Added some more dev\_t hacks for Alpha FreeBSD 4.0.

Added support for IPv6 on BSD 4.x. The support hasn't yet been tested, just compiled.

Added support for the mnt file system (mntfs or /etc/mnttab) on Solaris 8. Tested on Solaris 8 BETA-Refresh.

Made selection of optional fields (e.g., PPID with -FR) in a field output specification select the optional field, too, so that the option selector for the field (e.g., -R) isn't also required. This change was made in response to an inquiry from John DuBois <spcedt@armory.com>. This may require some revision to scripts that parse all field output; two scripts in the lsof distribution's scripts/ subdirectory had to be updated.

Corrected handling of Linux IPv4 addresses mapped in IPv6 addresses.

Tested under OpenBSD 2.6.

4.48 January 14, 2000

Modified -i argument processing of colon-separated IPv6 addresses to recognize an IPv4 address mapped in an IPv6 address and handle it as an IPv4 address. This was offered as a patch to 4.47.

Added a defined symbol (NOWARNBLKDEV) to control (inhibit) the issuance of a warning when no block devices are found. This was done anticipating its need in FreeBSD 4.x, but that dialect version no longer has any block devices, so HASBLKDEV was

disabled for it instead. NOWARNBLKDEV was left in place for possible use in the future.

Enabled KAME IPv6 Configure support for FreeBSD when `<netinet6/in6.h>` is found.

Disabled use of gcc to compile lsof for 64 bit HP-UX 11.

Updated Configure to recognize FreeBSD 3.4.

Based on suggestions from Bernt Christandl `<beb@MPA-Garching.MPG.DE>` improved AFS configuration for AIX and Solaris, and updated AIX AFS 3.5 support. Johannes Tax `<tax@bluedog.oit.unc.edu>`, Hung T. Pham `<hung_pham@unc.edu>`, and Curt Freeland `<curt@grumpy.cse.nd.edu>` provided test systems.

Updated lsof's private rnode definition for AIX 4.3.3, since IBM still doesn't ship the `<oncpus/nfs/rnode.h>` header file and the rnode structure definition in `<nfs/rnode.h>` doesn't match what the kernel uses. This was offered as a patch to 4.47.

Weakened the test in the Linux /proc-based lsof of the field count of data lines in `/proc/net/{tcp,udp}`. It appears that recent 2.3.x Linux kernels have added untitled fields to these files. The bug report came from Gabor Liptak `<gaborliptak@usa.net>`.

Adjusted for a FreeBSD 4.0 change in the definition of `[_]KERNEL`. David O'Brien `<obrien@NUXI.com>` reported the problem and provided a test system.

Removed the HASPPID bracket from Fppid (the -R option state variable) so that the field select table will compile even when HASPPID is not defined. This problem was introduced at revision 4.47 with code that causes some field output characters to set option states. The problem was reported by David Bacon `<bacon@birch.eecs.lehigh.edu>`.

4.49 April 3, 2000

Made clearer in man page that "Lxx" FDs are AIX loader table references. Also updated the 00FAQ discussion

of the Stale Segment ID bug to include  
AIX 4.3.x.

Modified support for NetBSD 1.4Q to include the  
<sys/buf.h> header file to cope with an MFS change.

Added support for OpenBSD UVM virtual memory.

Added support for AIX systems with > 2GB of memory.  
Chris Sylvain <csylvain@itg.ummc.umaryland.edu>  
reported the problem and provided the solution.  
Chris also supplied some minor code cleanup. This  
was offered as a patch to 4.48.

Based on new information from Igor Schein <igor@txc.com>  
made additional compensation in Configure script  
for 64 bit Solaris 7 and 8 gcc.

Added some 00FAQ info on the effect ordering of  
the +fg and -FG options has on output format.

Improved NetBSD IPv6 configuration, based on a  
suggestion from Thomas Klausner  
<wiz@danbala.ifoer.tuwien.ac.at>. Added code to  
convert IPv4-mapped-in-IPv6 addresses to IPv4  
addresses.

Updated the information in 00FAQ and the HP-UX 11  
binary directory README files on the HP-UX 11  
ipis\_s  
patch with new information supplied by Eric McWhorter  
<emcwhorter@xsis.xerox.com>.

Added documentation on changes to HASFSTYPE and  
HASNCACHE, and the new HASPRIVPRIPP.

Adjusted Configure for FreeBSD 5.0. Made additional,  
necessary changes to Configure and the BSDI sources  
to eliminate load errors.

Added KAME IPv6 support to FreeBSD at the request  
of Ollivier Robert <roberto@eurocontrol.fr>, who  
provided a test system.

Corrected the script that generates the CHECKSUMS  
files for binaries to correctly name the detached  
PGP certificate. The documentation bug was reported  
by Michael Hennecke <hennecke@rz.uni-karlsruhe.de>.

4.50 June 29, 2000

Added a NetBSD alpha test host, courtesy of Ray Phillips <r.phillips@mailbox.uq.edu.au>. An lsof 4.49 binary, built on Ray's 1.4.1 system was made available prior to the 3.50 release.

Upgraded the system map file tests in /dev/kmem-based Linux lsof, making the use of DEBIAN\_LINUX\_LSOF unnecessary.

Tested the changes on a system made available by Vincent Kujala <kujala@geog.ubc.ca> and Jim Mintha <jim@ic.uva.nl>.

Forced AIX to use the large-file-enabled versions of lstat (lstat64) and stat (stat64) if <sys/stat.h> contains stat64. This should allow lsof to stat() AIX files > 2GB even when the builder has not defined the "large file enabled programming environment." Configure tests <sys/stat.h> and puts -DHASSTAT64 in the Makefile's CFLAGS to make this happen. Fernando A.B. Whitaker <whitaker@cenapad.unicamp.br> reported the problem. This was offered as a patch to 4.48.

Enabled Configure script to handle OpenBSD 2.7. Angelos D. Keromytis <angelos@dsl.cis.upenn.edu> reported the availability of OpenBSD 2.7 and supplied the Configure script patch.

Improved handling of DOOR and fattach()'d files in Solaris.

Changed message about missing kernel symbol file from "not yet determined" to "none found".

Updated FreeBSD, NetBSD, NEXTSTEP, OpenBSD, and OPENSTEP support to report "no PCB" and the values of the SO\_CANTSENDMORE and SO\_CANTRCVMORE state flags when a socket structure has no inpcb pointer. This modification was made to AIX lsof at revision 4.46. Added an entry to 00FAQ about sockets that have no inpcb pointer.

Upgraded support for FreeBSD 5.0-CURRENT. Ben Smithurst <ben@scientia.demon.co.uk> supplied patches and did testing. David O'Brien <obrien@NUXI.com>

supplied a test system. The update included dropping the Fctty part of file descriptor file system support, conditional on a Configure script test. I propagated those changes to BSDI, NetBSD, and OpenBSD in anticipation of their having the modification in the future. David also arranged with Michael Haro <mharo@area51.fremont.ca.us> for a FreeBSD 3.4 test system.

In response to an lsof 3.72 bug report from Jim Mewes <jim@corp.phone.com>, added more kernel address filtering to the lsof function, kread(), that reads Solaris kernel data.

In response to a report from Marc Duponcheel <marc@offline.be>, added tests to the /proc-based Linux lsof to ignore file systems of types "autofs" and "pipfs".

Based on a report and information supplied by Casper Dik <casper@holland.Sun.COM>, updated the ncache\_load() function in lib/rnch.c with new code that deals with a post Solaris 8 change in kernel name cache (DNLC) handling. Casper tested the update, which should be invisible to Solaris versions without the new DNLC code.

Added support for Solaris VxFS QIO files, based on a report from Kieran Broadfoot <kieran.broadfoot@gs.com>. Kieran help test the support.

Added support for PTX 4.4.6 and 4.5[.1] with help from the usual cast of good people at Sequent.

Added support for 64 bit file sizes and offsets on BSDI, FreeBSD, NetBSD, and OpenBSD, based on a report from Dan Nelson <dnelson@emsphone.com>. Dan supplied a patch and did FreeBSD testing.

Added Configure script recognition of NetBSD 1.5, based on a report from Andrew Brown <atatat@atatdot.net>. Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at> updated the NetBSD port package to use a pre-release of this addition.

At the last minute saw a notice via deja.com's

UseNet search service that FreeBSD 3.5 had been released and lsof didn't grok it. Added recognition of 3.5 to lsof's Configure script, but didn't have the opportunity to test lsof on 3.5.

4.51 August 21, 2000

Added Configure script support for the upcoming Solaris 9 release based on suggestions from Casper Dik <Casper.Dik@holland.sun.com>.

Changed sample Perl scripts to assume that /usr/local/bin/perl is Perl 5 and Perl 4 may be found in /usr/local/bin/perl4.

Updated Configure to recognize FreeBSD 4.1 and made a FreeBSD pre-release distribution available.

Bela Lubkin <belal@sco.COM> tested lsof on the upcoming SCO OSR 5.0.6 release and reports that lsof appears to work properly.

Updated the AIX compiler test in Configure to recognize its version 5.

Updated AIX 4.3.3 support with automatic recognition of the proper rnode structure, based on machine bit width. Also added code to detect when processing the -X option that lsof has been compiled with the "other" AIX 4.3.3 user structure and to apply compensations. When a compensation method works, it's applied during subsequent -X processing; when none works, further -X processing is disabled.

Added Tru64 UNIX 5.1 support. Updated Tru64 UNIX library text file support to recognize new kernel support for AdvFS library files. Berkley Shands <berkley@cs.wustl.edu> and Klaus Saggerer USG [saggerer@zk3.dec.com] helped put me in contact with Chang Song <song@zk3.dec.com>, the developer of 5.1's new kernel name cache and he helped me develop new code in lsof to access it.

Corrected reporting of PTX fattach()'d address.

Changed Configure and dlsof.h for NetBSD and OpenBSD to



use /usr/include/uvm header files when available.

Andrew Brown <atatat@atadot.net>, Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at>, and Wolfgang Rupprecht <wolfgang@wsrcc.com> pointed out the need to do this for NetBSD. Andrew provided access to a NetBSD 1.5 system for verifying the changes.

Installed snprintf() support, including a private version in the lsof library for those UNIX dialects without the function. Changed all sources to use it instead of sprintf() and strcpy().

Fixed a memory leak in the readvfs() functions of BSDI, DEC/OSF1, Digital UNIX, FreeBSD, NetBSD, OpenBSD, and Tru64 UNIX.

Tested on Linux 2.4.

Modified the Pyramid MkKernOpts script to compensate for `uname -s` configuration alternatives. Robert Dahlem <Robert.Dahlem@ffm2.siemens.de> supplied the modification.

Obtained access to an FCS Solaris 8 64 bit system and built lsof on it, using Sun Workshop C 5.0 and gcc 2.96 20000814 (experimental). Both compilers produce a working lsof.

4.52 November 8, 2000

Completed work on an HP-UX 11.11 port that uses a pstat(2) interface provided by HP. To distinguish it from its predecessors for HP-UX, this lsof version is called PSTAT-based and the predecessor versions are now called /dev/kmem-based. I am indebted to the far-sightedness and support of these good people at HP for making PSTAT-based lsof possible: Carl Davidson, Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. The PSTAT-based sources are in lsof\_4.52/dialects/hpux/pstat, the /dev/kmem-based ones in lsof\_4.52/dialects/hpux/kmem.

Ported to IBM Monterey for Merced|Itanium, aka AIX 5L. It configures via the Configure script's "aix" abbreviation and has been tested on AIX 5L Beta 3. Jay Beck, Steve Dibbell, Loc Le, Nasser Momtaheni, and Malcom Zung of IBM provided generous support.

Since AIX 5L is still in Beta testing, this port can't be considered complete.

Added Configure support for OpenBSD

2.8. David

Mazieres <dm@cs.nyu.edu> provided a test system.

Based on a report from Marc Christensen <marc@mecworks.com> added sockfs to the mount scan exemption list for /proc-based Linux lsof.

Added large file, CDFS, and DOSFS for UnixWare 7.x. Added UnixWare device memory mapping support. All UnixWare changes were supplied by Eric Dumazet <edumazet@cosmosbay.com> Eric also supplied some miscellaneous bug fixes.

Deferred name cache loading until printname() needs to use the name cache.

Terminated Pyramid, SunOS 4.1.x, and Ultrix support, because test systems are no longer available. Final Pyramid and Ultrix source code distributions for lsof revision 4.51 may be found on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src. The no longer supported SunOS 4.1.x source code is still distributed with the Solaris source code.

Added code to set Solaris node address to real vnode address, when applicable.

John Speno <speno@lopan.isc-net.upenn.edu> provided information that enabled me to update the Tru64 AdvFS (MSFS) node definition for AdvFS version 5.

Added Tru64 5.x CFS support with help from Kris Chandrasekhar <Kris.Chandrasekhar@compaq.com>, Diane Lebel <lebel@zk3.dec.com>, and John Speno. The support only provides information about cached file attributes.

Installed a Configure patch for HP-UX 11 supplied by Kenneth Stailey <kstailey@disclosure.com> that adds another command to q4 input.

Tested on FreeBSD 4.2.

Will Day <willday@rom.oit.gatech.edu> and Frank Winkler <frank.winkler@germany.sun.com> graciously supplied Solaris 8 binaries.

Added Solaris 9 text file support, supplied by Casper Dik <Casper.Dik@holland.sun.com>.

#### 4.53 December 6, 2000

Added the AIX 5L j2\_lock.h to the distribution with a Configure script step to use it when it's missing from /usr/include/j2.

Removed SunOS 4.1.x support.

Removed Linux 2.0.x /dev/kmem support.

Fixed VBLK and VCHR special device file reporting to handle /dev information more accurately.

Added a Apple Darwin / Mac OS X 1.2 port, provided by Allan Nathanson <ajn@apple.com>. Allan also arranged for a test system so I can maintain this port. An additional test system was provided by Dale Talcott.

Dropped claims of support for all UnixWare versions except 7.1.0, since that is the only version on which I can test lsof. Even though lsof 4.53 is deprecated for UnixWare 2.1.3, installed a patch for it with testing done by A. Channing Clark <clark.channing@heb.com>.

Dropped claims of support for all SCO OpenServer versions except 5.0.5, since that is the only version on which I can test lsof.

#### 4.54 January 19, 2001

Added compensation for a change that made the FreeBSD mount structure invisible. I can only test back to 3.2 and the compensation works there, so it's been #ifdef'd for 3.2 and above. David O'Brien <obrien@FreeBSD.org> provided the necessary clue.

Based on a report from Valdis Kletnieks <Valdis.Kletnieks@vt.edu>, changed all IPv6 support to report a TYPE of IPv6 for sockets with IPv4

addresses mapped in IPv6 addresses. The previous lsof behavior was to report their TYPE as IPv4.

Restored the Linux Glibc test to Configure, removed at revision 4.53, based on a report from John Dzuberka <zube@cs.colostate.edu>, that RedHat Linux 6.0 still needs the test.

Made setting of link count for Solaris more selective.

Limited Readlink() recursion to MAXSYMLINKS. The bug was reported by Jan Dvorak <johndog@go.cz>.

Dropped the \*claim\* that lsof runs on Solaris 2.5.1. It may well do so, but I no longer have access to a test system.

Fixed an #endif comment typo, reported by Igor Schein.

Fixed a typo in a cast for a Tru64 UNIX 5.1 function and updated Configure for Tru64 UNIX 5.0 and 5.1 with information from Jesse Perry <jesse.perry@compaq.com>.

Corrected non-fatal typos in the AdvFS support in dnode.c for Tru64 UNIX.

Added msdos file system support for NetBSD and OpenBSD. Andrew Brown <atatat@atadot.net> requested and helped test it.

4.55 February 15, 2001

Based on a report from Bernd Eckenfels <eck@lina.inka.de> added support in lsof for files in /proc/<PID>/maps that have been deleted.

Changed PGRP output title to PGID, conforming to the most common current abbreviation for Process Group ID (PGID). While some systems continue to use \*pgrp for internal kernel variable names, most systems that support the display of PGID via ps(1) now title it PGID. The lsof -g and -Fg options operations are unchanged in function; only titles and descriptions have changed. Also changed internal variable names from \*PGRP and \*pgrp to \*PGID and \*pgid where possible.

Dropped the \*claim\* that lsof runs on HP-UX 9.x.

It may well do so, but I no longer have access to a test system.

In response to a suggestion from Jeff Howie <jeff.howie@federated.ca> added support for command name selection by regular expression. A new form of the -c option value is use to identify and specify a regular expression.

Restore the \*claim\* that Isuf works on UnixWare 7.0, since I re-acquired a test system.

4.56 May 3, 2001

Corrected some problems Amir Katz <Amir\_Katz@bmc.com> found with Insure++, one in lib/dvch.c, the rest in Solaris sources. Amir's report also helped me find an error in an snpf() call that caused (the unsupported) Solaris 2.5.1 Isuf to crash. Wally Winzer, Jr. <wally.winzer@ChampUSA.COM> helped test.

Added support for UnixWare 7.1.1 and above in-kernel UNIX sockets. John Hughes <john@Calva.COM> kindly provided code and access to a test system. John also provided a test system and advice for adding UnixWare 7.1.1 NonStop Cluster and CFS support. More help with that effort came from Kurt Gollhardt (SCO), Barbara Howe (SCO), Bela Lubkin (SCO), and Dewan Rashid <Dewan.Rashid@ir.com>.

Archived a set of compilation hints (patches) from Bill Melvin <Bill.Melvin@esc.edu> that make it possible to compile the old, unsupported Isuf 3.08 sources on UnixWare 1.x without NFS or CDFS support.

Installed support supplied by Allan Nathanson <ajn@apple.com> for the Darwin "Gold Master" release, Mac OS X 10.0 (aka Darwin 1.3 in its public source version). Added Allan's CVS repository suggestions to the script that gets additional header files from an open source repository.

Tested an HP-UX 11.11 kernel patch from Sailu Yallapragada that enables reporting of TCP/IP information for telnetd processes that use the telnet multiplexor. I don't yet know the kernel patch ID.

Made the Solaris inclusion of <inet/mi.h> conditional on the Solaris version. (It's apparently not needed at 2.6 and above.) Bill Watson <bill.watson@uk.sun.com> brought this to my attention.

Added alternate Linux 2.4.x lock extent test, supplied by Jim Mintha <jim@ic.uva.nl>.

Rearranged the lines and pre-processor tests in regex.h, lib/regex.c, and lib/snmp.c so that undef can be used to eliminate copyright and GPL statements when the files aren't being used for a particular dialect. (USE\_LIB\_\* definitions in a dialect's machine.h header file determine if one or more of those three files are to be used.)

Added preliminary support for Solaris 8 with VxFS 3.4. This support will be refined as I get information from Veritas about how they will distribute the kernel header files lsof needs. Those header files were omitted from the standard VxFS 3.4 distribution. Technical assistance and testing were provided by Calle Dybedahl <cdy@algonet.se>, Gary Millen <gary.millen@veritas.com>, Rainer Orth <ro@TechFak.Uni-Bielefeld.DE>, Peter C. Vernam <pvernam@draper.com>, and Donna Yobs <Donna.Yobs@veritas.com>

Tested on FreeBSD 4.3-STABLE.

Dropped the \*claim\* that lsof works on UNIX dialects where I no longer have test systems: BSDI 2.1, 3.[01] and 4.0; DEC OSF/1, Digital UNIX and True 64 UNIX 2.0 and 3.2; FreeBSD 2.1.[67], 2.2[.x], 3.[012345] and 4.[01]; HP-UX 10.20; NetBSD 1.[234]; SCO OpenServer 5.0.5; and SCO UnixWare 7.0

Tested on Solaris 9 BETA, s81\_36.

4.57 July 19, 2001

Help (-h) and version (-v) output now have URLs for the newly created and timeliest lsof FAQ (00FAQ in the lsof distribution) at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>

and the man page for the current lsof distribution  
at:

[ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof\\_man](ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof_man)

Based on a report from Steve Laubscher  
<slaubs@woodward.com>, modified dlsof.h for PTX  
4.6[.1] to avoid a temporary dnlc\_t definition  
needed at PTX 4.5.1.

Corrected test for old Linux kernels in Configure.  
Henri Karrenbeld <ishtar@cal044202.student.utwente.nl>  
brought the error to my attention. Limited Linux  
claims to 2.1.72 and above in the documentation.

Improved HP-UX 11 Configure  
stanza and stream socket  
handling.

Constructed a work-around for the HP-UX 11 optional  
OnlineJFS package. The work-around sadly requires  
lsof to have a private version of the vx\_inode  
structure, since the OnlineJFS package doesn't  
update <sys/fs/vx\_inode.h>. Troyan Krastev  
<Troyan.Krastev@ricoh-usa.com> brought the bug to  
my attention and Michael Bracewell  
<michael@ra.TSS.PeachNet.EDU> provided a test system  
where I developed the work-around.

Added locale support to lsof's isprint() test,  
based on a suggestion from Dan Mercer <damercer@mmm.com>.  
lsof will use setlocale(), when that function and  
its supporting <locale.h> header file are available.

Added OpenBSD 2.9 support.

Based on a report from Aaron Rhodes <arhodes@psionic.com>  
and with testing help from Aaron, made the lsof  
4.56 revision compile and work on OpenBSD 2.6.  
While that OpenBSD version is no longer supported,  
Aaron's report exposed a Configure script bug  
affecting OpenBSD versions  
lsof does support.

Updated for FreeBSD 5.0-CURRENT. Szilveszter Adam  
<sziszi@petra.hos.u-szeged.hu> help test. The lsof  
FreeBSD ports packager, David O'Brien <obrien@FreeBSD.org>,

assisted.

Tested on AIX 5.1. Loc Le and Nasser Momtaheni of IBM provided test systems.

4.58 September 13, 2001

Added options to safestrprt() and safestrprtn() to surround the string with "" and to suppress the printing of an ending '\n'. Use of these functions in device cache file error message reporting answers a suggestion for better error reporting from John Jackson <jrj@purdue.edu>.

Fixed a Solaris 2.6 and above problem related to searching for "large" (O\_LARGEFILE) files by name; lsof was using the wrong version of [l]stat(2). The bug was reported by Daniel Trinkle <trinkle@cs.purdue.edu>.

Added AIX 4.1.4 and above XTI socket support.

Added OSR Xenix Shared Data and Semaphore file type support with modifications supplied by Bela Lubkin.

Updated

OPENSTEP support with modifications from Carl E. Lindberg <lindberg@clindberg.org>. The changes enable the correct reporting of executable and library open files ("txt" type).

Limited claims of OpenServer support to the versions where I currently test, 5.0.4 and 5.0.6. (Lsof probably works on 5.0.5.)

Enabled processing of -C option for PSTAT-based HP-UX lsof.

Enabled and tested on FreeBSD 4.4.

Corrected a file system test example in 00QUICKSTART, based on a report from Jun Biao WANG <>wangjunb@cn.ibm.com>.

Made available for re-distribution a user-contributed port of lsof 4.51 to Reliant UNIX 5.45. Thomas Mauterer <Thomas.Mauterer@philosys.de> contributed the port.

4.59 October 20, 2001



With the closing of the Sequent Synergy Links Lab by IBM, terminated lsof support for PTX. The last tested PTX lsof revision, 4.58, is available on lsof.itap.purdue.edu in ../lsof/OLD/src.

Adjusted for FreeBSD 5.0-CURRENT NFS header file changes, based on a report from Jos Backus <josb@cncdsl.com>.

Corrected a bug in the way Linux lsof identifies the owner of a process. Lionel Cons <lionel.cons@cern.ch> reported the problem and tested the fix. Added code to avoid stat(2) calls on regular Linux files whenever possible. Lionel reported the need to do this (AFS files) and tested the new code.

Added new output field for raw device number in hex. The field is identified with 'r'. This field is NOT selected when -F or -F0 is specified so that its appearance won't disturb existing scripts that process field output.

Added support for OpenUNIX 8. A test system was provided by Larry Rosenman <ler@lerctr.org>. Matthew Thurmaier <matt@compclass.com> and many people from Caldera provided technical assistance.

Added an additional UVM test to the NetBSD Configure stanza. Andrew Brown <atatat@atatdot.net> supplied the test; it recognizes NetBSD 1.5Y UVM changes to the vnode structure recently committed by Chuck Silvers.

Applied Configure and get-xnu-headers.sh script changes supplied by Allan Nathanson <ajn@apple.com> for Darwin 1.4.

Added for Bela Lubkin <belal@mammoth.ca.caldera.com> OSR-specific environment variables to supply values to the Configure script. The variables are described in 00XCONFIG.

Added an IP version selector to the -i option parameters.

4.60 November 9, 2001

Added special handling to and corrected bugs in the matching of IPv4 in IPv6 addresses to -i6:<...> selectors.

Made 00FAQ corrections and updates, based on discussions with Igor Schein <igor@txc.com>.

Modified Configure script to detect a 64 bit capable gcc compiler and permit it to be used to build 64 bit (PA-RISC 2) lsof for HP-UX 11.00. Tested with HP's gcc package, which Rich Rauenzahn of HP kindly installed on a test system at HP. Stefan Marquardt <stefan.marquardt@hagebau.de> helped test.

Made lsof's method of killing its child process more robust, based on a suggestion from Bela Lubkin <belal@caldera.com>.

Modified all dialect Makefile segments to accept select -v #define's from the environment -- a builder's comment, host, logname, system information and user name. This was done for Bela Lubkin, so he can "tune" the -v output when he packages lsof in the upcoming Caldera OSR 5.0.7 release.

Changed Perl scripts in scripts/ to put the lsof path consistently in \$LSOF. Also added a fix from Bela Lubkin to scripts/big\_brother.perl5 that allows it to tolerate SCO OSR "ago" clauses in open UDP file information. Strengthened emphasis in scripts/00README that the scripts are examples that shouldn't be expected to run on all UNIX dialects without modification.

At Bela Lubkin's suggestion changed the device cache file format examples in 00DCACHE and 00FAQ to avoid "%U%". That's an SCCS escape sequence.

Added support for OpenBSD 3.0.

Added +DAportable to CFLAGS for 32 bit HP-UX 11. Amir Katz <Amir\_Katz@bmc.com> suggested the addition.

4.61 January 22, 2002

Updated field output example Perl scripts in the scripts/ subdirectory to discover the lsof path,

starting at .. and proceeding through the PATH environment variable's directories.

Added minor OSR Configure script fixes, provided by Bela Lubkin <belal@caldera.com>.

In response to a report from Joshua Wright <Joshua.Wright@jwu.edu> modified NetBSD and OpenBSD Configure stanzas and sources so that lsof can be built when there is no system source tree (e.g., /usr/src/sys).

In response to a report from Peter Valchev <pvalchev@openbsd.org> improved the UVM test in the OpenBSD Configure stanza.

Updated Configure script to recognize FreeBSD 4.5. Updated for FreeBSD 5.0 procs and pseudofs changes.

Updated HP-UX stanza to see if the compiler named in the LSOFF\_CC environment variable is the bundled compiler. If it is, "-O" is omitted from the compiler flags.

Updated Digital UNIX 4.x and Tru64 UNIX error message related to kernel name list failures. Added an FAQ section about how a kloadsvr daemon failure can cause knlist(3) to fail. The condition was reported by Douglas B. Jones <douglas@gpc.peachnet.edu>

Based on a report from Mark W. Eichin <eichin@thok.org> made Linux lsof capable of handling and reporting file sizes greater than 32 bits.

Tested on Solaris 9 BETA-Refresh.

Corrected a bug in the matching of IPv4 addresses, mapped in IPv6 addresses, to an IPv4 parameter to an -i option.

Ported to 64 bit Power AIX 5.1 kernel with advice from David Clissold <cliss@austin.ibm.com> and Marc Stephenson <marc@austin.ibm.com>, and on a test system provided by Loc Le <lple@us.ibm.com>.

4.62 March 7, 2002

Updated 00README to reflect the usefulness of gcc

for building AIX lsof. Documented a report from Brian L. Gentry <BGentry@nationsrent.com> of success on AIX 4.3.3. I documented my success on 32 bit Power AIX 5.1 and my lack of success on ia64 AIX 5.1 and 64 bit Power AIX 5.1.

Improved UnixWare >=7.1.1 reporting of UNIX socket NAME field information for NonStop Cluster systems with a patch provided by John Hughes <john@Calva.COM>. Offered John's improvement as a patch to lsof 4.61.

Corrected bugs in handling of open files on block devices by OSR lsof. The bugs were reported by Bela Lubkin <filbo@deephought.armory.com>.

Fixed bug in writing >32 bit device numbers for block devices to the device cache file.

Added support for reporting block special nodes not in /dev (or /devices). That required "like device special" be changed to "like block special" and "like character special". (00FAQ was updated.)

Based on a report from Peter Valchev <pvalchev@openbsd.org> improved the definition of the source for NetBSD and OpenBSD kernel symbols (the nlist() source file). NetBSD now defaults to getbootfile(3) if it is available, /netbsd otherwise. OpenBSD now defaults to /dev/ksyms if it is available, /bsd otherwise.

Made possible compilation under BSD/OS (BSDI) 5.0 with changes to Configure, dialects/bsdi/dlsof, dialects/bsdi/dproc.c and lib/rnmh.c. The changes were suggested by Steven Hinkle <hinkle@bsdi.com>. Note that these changes do not substantiate a claim that lsof works on BSDI 5.0, because I haven't tested it there.

Updated OpenUNIX private <sys/fs/memfs\_mnode.h>, based on a report from Larry Rosenman <ler@lerctr.org> that it had been updated by Caldera patch OU800PK3. Unfortunately the patch only corrects some of the problems with the header file, so it is still necessary to distribute a private patched version of it with the lsof sources.

Applied a man page correction reported by Frederic Delanoy <max\_ok@yahoo.com>.

Corrected cast bugs related to using the HP-UX bundled C compiler on HP-UX 11.11.

#### 4.63 April 23, 2002

Added HPUX\_BOOTFILE environment variable for use by the Configure script in determining HP-UX kernel configuration information -- e.g., the state of the ipis\_s structure in the HP-UX 11 kernel. The change was suggested by Marc Bejarano <beej@alum.mit.edu>. Marc also suggested some changes to the HP-UX section in 00FAQ that discusses Configure's use of q4 for HP-UX 11.

Fixed a bug in the Solaris lsof file system matching code. It was not reporting that VCHR files in /devices were in / when /devices was in /, too.

Corrected bugs in device number, file size, file offset, and raw device number field output generation.

Added recognition of OpenBSD 3.1 to the Configure script with a suggestion from Peter Valchev <pvalchev@sightly.net>. Note that this change does not constitute a claim that lsof works on OpenBSD 3.1, because I haven't tested it there.

Built an automated test suite. (See 00TEST and the tests/ sub-directory of the lsof main directory). Bela Lubkin requested it. Dale Talcott, John Hughes, and Larry Rosenman helped me validate it on their systems.

During the development of the test suite I discovered the following lsof bugs or missing features, and corrected or supplied them.

- \* Corrected the reporting of locks for:
  - o Digital UNIX 4.0d and Tru64 Unix 5.[01];
  - o HP-UX 10.30 and 11.00;
  - o OpenUNIX 8;
  - o UnixWare 7.1.1.

- \* Enabled HP-UX 10.30 and 11.00 to report open NFS file link counts.
- \* Corrected the reporting of UNIX domain socket names for Apple Darwin, FreeBSD 4.5 and above, NetBSD 1.4.1 and above, and for OpenBSD 3.0 and above.
- \* Enabled HP-UX 11.11 to stat(2) large files.
- \* Fixed handling of combination 32 and 64 bit device numbers in AIX 64 bit architectures.

Updated the AIX 4.3.3 NFS mode recognition code, first installed at revision 4.51. It looks like some IBM update has restored a single rnode structure independent of the machine bit width.

Updated the NetBSD and OpenBSD sources so NetBSD can process DTYPE\_PIPE files, as OpenBSD was already able to do.

Updated Darwin get-xnu-headers.sh script to reflect information about a recent reorganization of the Darwin CVS hierarchy, supplied by Allan Nathanson <ajn@apple.com>.

Added defense against the standard I/O descriptor attack.

4.64 June 26, 2002

Corrected some FreeBSD pre-processor directives. David O'Brien <obrien@NUXI.com> pointed them out.

Updated lsof's main() function to: 1) close all open file descriptors above 2 before starting; and 2) to set a non-interfering umask. Moved GET\_MAX\_FD test from misc.c to proto.h, so that main() could use it. Added multiple-include protection to proto.h.

Moved FAQ's test suite Q's & A's to a more appropriate section. Added a Q&A on HASSECURITY option and its affect on searching for open files. (That was already in the man page.)

Updated hpux/kmem/dnode.c for HP-UX < 11 compilation

with information from John Dzuberá <Zube@CS.ColoState.EDU>.

While

lsof doesn't support HP-UX < 11 any more, I try to avoid disabling it there when possible, and a locking fix for HP-UX >= 11 in lsof 4.63 inadvertently disabled compilation of lsof for HP-UX < 11. Fixed long-standing bug in HP-UX 10.20 lock reporting.

Removed language from the test suite programs that requires an ANSI-C compiler. This allowed the test suite to be validated with cc and gcc on the unsupported HP-UX 10.20.

At the suggestion of Manuel Bouyer <bouyer@antioche.eu.org> switched NetBSD and OpenBSD lsof from using nlist() to using kvm\_nlist(). Made the same change for BSDI, Darwin, and FreeBSD.

Validated test suite on OPENSTEP 4.2.

In response to a suggestion from Jeff Stoner <jstoner@blackboard.com> enhanced support for the FD list of the -d option to allow it to be either an exclusion or inclusion list, using the '^' prefix to denote exclusions.

Made adjustments for FreeBSD 4.6 and 5.0-CURRENT. Fixed a FreeBSD /etc/make.conf CFLAGS extraction bug, reported by Kris Kennaway <kris@obsec.org>, and new a bug in the fix, reported by Eric Cronin <ecronin@eecs.umich.edu>

Added nullfs support for FreeBSD, NetBSD, and OpenBSD at the request of Andrew Brown <atatat@atatdot.net>.

Modified all readmnt() functions to ignore mounted-on directory names that don't begin with '/'.

Tested on NetBSD 1.6A and OpenBSD 3.1.

Upgraded to Solaris 9 FCS with two changes to the BETA-Refresh support: 1) an adjustment to dnode.c for a change in the so\_so (sonode) structure; and 2) addition of Solaris 9 FCS specific DNLC code. David Comay <David.Comay@Eng.Sun.COM> sent me the dnode.c change and Casper Dik <Casper.Dik@sun.com>

helped with the new DNLC support code.

Applied OpenUNIX changes that permit lsof to compile and run on the upcoming 8.0.1 release. The changes were supplied by Robert Lipe <robertl@caldera.com>. Larry Rosenman <ler@lerctr.org> provided a test system.

Added  
Solaris fd file system support.

4.65 October 10, 2002

Adjusted for change in FreeBSD 5.0-CURRENT inode structure, reported by David O'Brien <obrien@NUXI.com>. Adjusted for changes in FreeBSD 5.0-CURRENT <sys/vnode.h>. One change was reported by Anders Nordby <anders@FreeBSD.org>. Adjusted for FreeBSD 5.0-CURRENT on sparc64 architecture.

Enhanced the error reporting of Solaris lsof when it detects a kvm\_open() failure, and added a 00FAQ entry on the cause, based on a report from Peter J. Bertocini <pjb@anl.gov>.

Enabled compiling of lsof for NetBSD 1.5 with the NULL file system, using a patch from Andrew Brown <atatat@atadot.net>.

Removed a hack in the LTbigf test program that was once needed when it was compiled on Solaris 9 BETA-Refresh with gcc. The hack isn't needed on Solaris 9 FCS. Janet Hempstead <jan@library.carleton.ca> brought the need for this change to my attention.

Applied a patch, supplied by Andrew Brown <atatat@atadot.net>, that updates lsof for NetBSD version 1.6F. Corrected handling of the NetBSD nullfs.

Updated to BSDI BSD/OS 4.3 on a test system kindly provided by Terry Kennedy <terry@tmk.com>.

Updated to FreeBSD 4.7.

Updated to Apple Darwin 1.5, 5.x and 6.x with patches supplied by Allan Nathanson <ajn@apple.com>. The patches include IPv6 support.



Updated Configure to use the -bnolibpath loader option when building lsof on a PowerPC, running AIX 5 or greater. Valdis Kletnieks <Valdis.Kletnieks@vt.edu> informed me this was needed. Lsof for AIX 5.x was initially developed on the IA64, where -bnolibpath can't be used and I didn't think to restore it to PowerPC loads when AIX 5.x became available for that architecture.

Updated to UnixWare 7.1.3 on a test system provided by Larry Rosenman <ler@lerctr.org>. Removed claims that lsof works on OpenUNIX 8.0.1, because UnixWare 7.1.3 is the release name of OpenUNIX 8.0.1.

Based on a comment that his e-mail address was wrong in the lsof distribution from Kenneth Stailey <kstailey@disclosure.com>, removed all e-mail addresses from lsof documentation files except this one, 00DIST. The addresses in 00DIST are used to send revision release notices to those who contributed to a revision, but the addresses in this file for previous revisions and in other documentation files sometimes grow stale and are never validated.

4.66 December 22, 2002

Acquired Solaris 7 and 8 test systems, courtesy of John Dzuberka <Zube@CS.ColoState.EDU>. Updated 00TEST and tests/TestDB accordingly.

Clarified FreeBSD 5.0 architecture claims at the suggestion of David O'Brien <obrien@NUXI.com>. Also implemented David's suggestion to change Intel to x86.

Installed changes to DNLC handling in OSR lsof in preparation for handling changes in the OSR 5.0.7 DNLC cache. Information about the changes and patches to handle them were supplied by Bela Lubkin <filbo@deepthought.armory.com>.

Upgraded True 64 UNIX support to the 5.1B release on a test system provided by Berkley Shands <berkley@cse.wustl.edu> Had to use relaxed ANSI compilation because of an error in a system header file and other lsof source usages.

Implemented the HASNOSOCKSECURITY compile-time option. When it and HASSECURITY are defined, lsof will be built to list only the user's open files, but will also list anyone else's open socket files, provided the "-i" option selects their listing. Updated the Customize script to ask about setting HASNOSOCKSECURITY. Left it undefined in all dialect machine.h header files. This change was requested by Kenneth Stailey <kstailey@speakeasy.net> for use with ntop.

Added support for OpenBSD 3.2 and its kernel trace file.

Improved lsof help (-h) and version (-v) information reporting.

Fixed a FreeBSD 4.7 and above off-by-two UNIX domain socket path termination bug, reported by Ken Stailey <kstailey@speakeasy.net>

4.67 March  
27, 2003

Began the transition of the lsof ftp server host name from vic.cc.purdue.edu to lsof.itap.purdue.edu. That reflects Purdue organizational changes. This first step makes the new name an alias to the old one. The old name, vic.cc.purdue.edu, will remain usable for an extended period.

Corrected a revision number reference in section 17.17 of 00FAQ on the appearance of Solaris negative DNLC caching handling.

Updated 00FAQ discussion of compilers for 64 bit Solaris.

Validated test suite for 64 bit Solaris 8 and gcc.

At the request of Alek O. Komarnitsky <alek@komar.org> added the "+c <width>" option to enable optional changing of the COMMAND column output maximum width from the default to <width>. The default maximum width remains CMDL, as defined in lsof.h.

Fixed three AIX kernel bit size detection bugs, one in the AIX Configure script stanza, the second

and third in the AIX dproc.c get\_kernel\_access() function.

The bugs were reported by Pierre-Yves Fontaniere <pyf@cc.in2p3.fr>, who tested the fixes.

Added kernel event queue file support for FreeBSD, NetBSD and OpenBSD. Andrew Brown <atatat@atadot.net> supplied the code.

Updated to AIX 5.2 on a test system provided by Dale Talcott <dtalcott@purdue.edu>. Had to build work-arounds for two missing AIX 5.2 header files, <j2/j2\_snapshot> and <proc/proc\_public.h>. Corrected an off-by-one UNIX socket addressing bug. Taught AIX lsof to handle both jfs and jfs2 files at the same time. Adjusted for an IBM mistake in the sizing of the fdsinfo structure in <procinfo.h> Toshiya Nakamura <TOSHIYAN@jp.ibm.com> helped test,

Updated to FreeBSD 4.8. Corrected another bug in FreeBSD UNIX domain socket name handling.

Corrected gcc build problems on HP-UX 11i, reported by Yuliy Minchev <yuliy@mobiltel.bg>.

Updated BSDI BSD/OS support to 4.3.1.

Augmented a lock ID test on NetBSD to check if the ID is an LWP pointer.

4.68 June 18, 2003

Enhanced Configure script's cleanup operations.

Added support for OpenBSD 3.3, based on a report from Peter Valchev <pvalchev@sightly.net>.

Improved the description of the detached PGP signature certificate file in the main lsof README file, based on a suggestion from Diana Stockdale <diana@mpl.ucsd.edu>.

Installed a work-around for FreeBSD 5.0-CURRENT on Alpha to avoid a compiler register use complaint.

Corrected a 'c' option error message. Gnele <blaadeleng@yahoo.com> reported the problem.

Upgraded EXT2FS and UFS support for NetBSD and OpenBSD to handle new inode information, and the fast UFS1 and UFS2 file systems.

With the help of Andrew Brown <atatat@atadot.net> determined the NetBSD snapshot (1.6F) at which <sys/mount.h> could be included under \_KERNEL, thus eliminating the lsof netexport.h hack. The same change applies to OpenBSD versions 3.3 and above.

Applied a patch from Armin Gruner <ag@muc.de> that corrects the use of the HASPROCFS definition in the FreeBSD dialect sources.

Corrected spelling errors in 00FAQ and in the generated 00.README.FIRST\_<version> file of the distribution archive. John Jackson <jrj@purdue.edu> and Ray Phillips <r.phillips@jkmrc.uq.edu.au> spotted and reported the errors.

Corrected a spelling error in a comment and incorrect use of an alarm function in the LTsock test program.

At the suggestion of Stuart Anderson <sba@srl.caltech.edu> added preliminary (and incomplete) SAM-FS file system support to Solaris lsof. Completion awaits availability of SAM-FS internals.

Fixed a Solaris device name printing bug, reported by Ric Anderson <ric@tick.Telcom.Arizona.EDU>, only visible when HASDCACHE is not defined. Ric helped test the fix.

Fixed an AIX kernel bit size handling bug related to the NFS node (rnode) structure.

Corrected a print\_kptr() function call error in the AIX AFS code, reported by David Steiner <david.r.steiner@Dartmouth.EDU>. Upon further reflection and because I no longer have appropriate AIX AFS test systems, disabled AIX AFS support in the Configure script for AIX versions above 4.3.3.0 or AIX AFS versions above 3.5.

Added support for FreeBSD 5.1.

With advice from Allan Nathanson <ajn@apple.com> adjusted

the Darwin get-xnu-headers.sh script to access the kernel header files needed by lsof from a new form of the Apple open source repository.

Installed Linux and lsof library bug fixes and improvements, supplied by Marian Jancar <mjancar@suse.cz>. One Linux improvement handles mount strings that have octal escapes in them, eg., \040 for embedded blanks. Marian tested the changes.

4.69 October 16, 2003

Received and applied an OpenBSD patch from Peter Valchev <pvalchev@sightly.net> that replaces a ctob() call with a sysconf() call. Peter claims sysconf() is needed for OpenBSD on SPARC. (It is not needed for NetBSD on SPARC.)

With the upgrade of my only Solaris 7 test system to, Solaris 8, dropped the \*claim\* that lsof works on Solaris 7. That doesn't mean it won't work there, so those who want lsof for Solaris 7 probably should be able to build it there and it probably will work there.

Revised lsof's DNLC handling for BSD derivatives, including: BSDI; Darwin, DEC OSF/1, Digital UNIX and Tru64 UNIX; FreeBSD; NetBSD; and OpenBSD. The latest NetBSD distribution's dropping of the vnode capability ID (v\_id) required the revision.

Adjusted to the latest FreeBSD 5.1-CURRENT.

Added NetBSD support for using kvm\_getproc2().

Added a patch from Andrew Brown <atatat@atadot.net> to handle NetBSD enum conflicts and changes in the <miscfs/kernfs/kernfs.h> and <miscfs/procfs/procfs.h> header files.

Added a "#define \_KERNEL" to the AIX dnode2.c source file for compatibility with a new <j2/j2\_inode.h> AIX 5.2 header file version. The addition was supplied by Dick Dunbar <Dick.Dunbar@Siebel.com> and was offered as a patch to lsof 4.68/

Added support for a second type of Solaris SAMFS. Stuart Anderson <sba@srl.caltech.edu> provided the

support. SAMFS support in lsof SOLARIS remains scanty, because Sun won't release any details on its kernel structures.

Dropped the \*claim\* that lsof works on AIX 4.3.3, because I was unable to test it there. That doesn't mean it won't work there, so those who want lsof for AIX 4.3.3 probably should be able to build it there and it probably will work there.

Updated for Solaris 10 on test systems provided by Mike Miscevic <miscevic@hotpop.com>. Casper Dik <casper@holland.sun.com> provided significant help. During the Solaris 10 port found and fixed an lsof handling bug that prevented reporting of open lsof file lock status.

Updated the DNLC test, LTdnlc, to provide a possible explanation about file systems on which the test might fail.

Modified the procedure for obtaining missing Darwin XNU kernel header files. The new one requires more manual intervention, but is the best that can be done with the way Apple open sources are now organized. 00FAQ explains the new procedures for those not used to downloading Apple open source files.

Added support for Apple Darwin 7.0 (Mac OS X 10.3) with patches supplied by Allan Nathanson <ajn@apple.com>. Dropped the \*claim\* that lsof builds and works on Apple Darwin below 6.0.

Validated lsof on FreeBSD 4.9, using a test system provided by Ben Lewis <bl@purdue.edu>.

Validated lsof on FreeBSD 5.1-CURRENT for Amd64. David O'Brien <obrien@FreeBSD.org> provided a test system.

Changed the NetBSD Configure stanza to do header file searches in /usr/include by default. The LSOF\_INCLUDE and NETBSD\_SYS environment variables may still be used to specify other search paths.

Discussions with Andrew Brown and Wolfgang S. Rupprecht <wolfgang@wsrcc.com> led to the change.

4.70 January

16, 2004

Improved shell-portability of the linux stanza of the Configure script with a patch from Paul Jarc <prj@po.cwru.edu>.

Added a "silent" rule to tests/Makefile for Paul.

Updated, extended and clarified the test suite documentation in 00FAQ and 00TEST.

Fixed Solaris 10 dlsof.h typo, reported by Mike Miscevic <miscovic@hotpop.com>. The typo prevents lsof from loading cleanly in Solaris 10 builds past 40.

Fixed a Solaris HSFS node number reporting bug and added a structure definition work-around for Solaris 10.

Converted PGP signing to GPG. My previous PGP key can be used, but the gpg "--allow-non-selfsigned-uid" option may have to be used when it is imported into a GPG key ring.

Added bz2 compression.

Updated for OpenBSD 3.4.

Added a work-around for a missing header file in the s10\_44 Solaris 10 build.

Added support for FreeBSD 5.2-BETA and 5.2-CURRENT.

Updated Linux AX25 support with modifications supplied by Lutz Poetschulat <dl9cu@db0zwi.de>.

Added raw IPv6 support to Linux lsof.

Improved handling of parameters after "-i@".

Improved file name test in LTdnlc.c.

Added loop count controls to the reading of Solaris lock chains. The change was implemented as a result of a report from Steve Gonczi <steve@relicore.com>.

Based on a report from John Jackson <jrj@purdue.edu>.

enabled a Solaris 10 <sys/lgrp.h> work-around for Solaris 9, too. (Patch 112233 installs an lgrp.h on Solaris 9 that needs the work-around.)

With help from Andrew Brown <atatat@atadot.net> and John Heasley <heas@netbsd.org> added log-structured file system (LFS) support for NetBSD and OpenBSD.

Added AMD64 to the list of FreeBSD 5.x-CURRENT supported architectures. FreeBSD.org provides a test system, courtesy of (I believe) David O'Brien <obrien@FreeBSD.org>.

Added a cast to lseek() in the HP-UX /dev/kmem-based kread() function to make it work properly with the bundled HP C compiler.

4.71 March  
11, 2004

Added text file support to Apple Darwin lsof and enabled the lsof executable portion of the LTbasic test. Added support for Darwin kernel queue, POSIX semaphore and POSIX shared memory files. Tested on Darwin 7.2 (aka Mac OS 10.3.2).

Added process\_kqueue() function prototypes for FreeBSD, NetBSD and OpenBSD.

Picked some lint in AIX sources, lib/rnmh.c and tests/LTsock.c.

Added "-x [fl]" cross-over option, which enables +d and +D processing to cross over symbolic links and/or file system mount points. Discussion with Johan Lindquist <johan@smilfinken.net> and Eric Williams (aka The Ghost In The Machine) <ewill3@earthlink.net> on Linux news groups revealed the need for the option.

Updated support for UnixWare 7.1.4.

Added support for the optional reporting of socket options, socket states and TCP flags for most currently supported dialects. John Smith <lbalbalba@hotmail.com> and Tristan Nefzger <tn@bhtrader.com> requested the information.

The dialects and their versions for which this feature has become available include:



AIX 4.3.2 and 5.[12]  
Apple Darwin 7.2  
BSDI BSD/OS 4.3.1  
Digital UNIX and Tru64 UNIX 4.0  
FreeBSD 4.9 and 5.2  
HP-UX 11 and 11.11 (aka 11i)  
NetBSD 1.6ZH  
OpenBSD 3.4  
OPENSTEP 4.2  
OpenUNIX 8  
SCO OpenServer Release 5.0.6  
Solaris 2.6, 8, 9 and 10  
UnixWare 7.1.[134]

Modified the Configure stanza for HP-UX 11 with better q4 detection. Steve Bonds <3vhmxxm02@sneakemail.com> supplied the modification.

Applied a patch from Mike Miscevic <miscevic@hotpop.com> to enable lsof to compile with the zone support in the Solaris 10 s10\_b51 release. Added information on lsof zone behavior to 00FAQ.

Added a "-z [z]" option to Solaris 10 lsof. It enables the listing of zone name and can also be used to select the listing of processes and their files from specified zones.

4.72 July 13, 2004

Corrected

Solaris 10 ZONE column title display bug with a patch from Joep Vesseur <Joep.Vesseur@Sun.COM>. Joep's fix was offered as a patch to 4.71.

Based on a report from Jean-Pierre Radley <jpr@jpr.com> about an unexpected GNU uname Configure interaction on OSR, and working from information received from Bela Lubkin, changed the OSR Configure stanza to use /bin/uname instead of uname. Added an FAQ entry about Configure version detection problems.

Added the +m and "+m m" options in response to a dialog with Robert T. Brown <rbrown@netmentor.com>. The options allow the creation of a mount table supplement file which can be used on selected dialects to get device numbers when stat(2) and lstat(2) can't deliver them. (That's generally the result of an inaccessible NFS server.) Currently the new options are supported

only on Linux.

Made cpumask\_t typedef \_KERNEL compensation for FreeBSD 5.2-CURRENT. Refined it for 5.2.1-RELEASE with testing help from Scott Ellentuch <tuc@tts.com>.

Added support for FreeBSD 4.10. Larry Rosenmann <ler@lerctr.org> kindly provided a test system.

Added support for NetBSD 2.0 with patches supplied by Andrew Brown <atatat@atadot.net>. Andrew also provided two test systems.

Made handling of Linux maps file more robust, based on a report from Jan Blunck <J.Blunck@tu-harburg.de>. As a side benefit, made handling of generated stat(2) information more flexible.

As a result of a discussion with Jason Fortezzo <fortezza@mechanicalism.net>, adjusted lsof for Solaris to obtain the maximum user name length from ut\_name of the utmpx structure, if <utmpx.h> exists.

Tested under OpenBSD 3.5.

Updated 00README information about using gcc (via the Configure aixgcc abbreviation) to compile lsof on AIX. Ann Janssen <ajanssen@nebook.com> made me aware the information was out of date.

Added an AIX SIGDANGER handler and some 00FAQ sections on lsof memory usage after a discussion with Tom Qin <tom.qin@citigroup.com> about lsof memory usage.

Added scripts/sort\_res.perl5, contributed by Fabian Frederick <fabian.frederick@gmx.fr>. The script displays lsof output sorted by size and path name.

Improved handling of files on Linux NFS mount points that use the root\_squash option, based on discussions with Paul Szabo <psz@maths.usyd.edu.au>.

Updated FreeBSD 5.2-CURRENT support, based on a problem report from Filippo Natali <filippo@widestore.net>.

Corrected improper FreeBSD 5.x-CURRENT #if condition,

reported by Kim Culhan <kimc@kim.net>.

Added a Configure script work-around for AIX 5.2 lsof with JFS2, compiled by gcc >= 3.3. The work-around was supplied by Florian M. Weps <fmw@hactrn.ch>.

4.73 October 21, 2004

Added an `__XPG4_CHAR_CLASS__` #define before #include'ing <ctype.h> on Solaris to restore lsof's ability to display special characters such as acute-e.

Added wide-character (e.g., UTF-8) support where possible,

prompted by a request from Kyungjoon Lee <kjoonlee@gmail.com>. Some older dialects -- e.g., NetBSD 1.4.1 -- don't support wide characters, so the wide character support is enabled by definitions in each dialect's machine.h. Dialects with wide-character support are listed in 00FAQ.

Make a FreeBSD 5.2-CURRENT adjustment for <sys/pipe.h>, supplied by Sergey A. Osokin <osa@FreeBSD.ORG>.

Implemented a Linux feature request made by Jakub Jelinek <jakub@redhat.com> that enhances lsof's ability to locate UNIX domain sockets whose paths are named as arguments. Jakub supplied suggested code.

Dropped \*claims\* that lsof works on AIX below 5.1, SCO  
Dropped \*claims\* that lsof works on AIX below 5.1, SCO  
Openserver 5.0.4, Tru64 UNIX 5.0, and UnixWare below 7.1.4. Lsof will probably build and work on those UNIX dialect versions, but I no longer have any way to test lsof on them.

Added support for FreeBSD 5.3 and 6.0. The FreeBSD 5.3 support hasn't been tested.

Added FD test code that will allow dialect versions to test FD option selections. Used the new code in the PSTAT-based HP-UX lsof to enable it to avoid scanning the mount table when its information is not needed. The addition was made in response to a query from Harvey Garner <Harvey.Garner@championusa.com> about lsof performance in a busy NFS environment.

Upgraded lsof's AIX support level to AIX 5.3, based on

a report from Dick Dunbar <Dick.Dunbar@Siebel.com>. (I have not tested lsof under AIX 5.3.) Based on Dick's recommendation and local testing changed the C for AIX version 6 and higher -qmaxmem option value to -1.

Made LSOF\_AR environment variable more useful and documented it in 00XCONFIG.

Corrected the use of sum(1) to generate signatures for the lsof distribution and binaries to match the documentation that claims it is sum -r output. Jin Guojun <jin@george.lbl.gov> noticed and reported the problem.

Tested under OpenBSD

3.6.

Added checksum and GPG certificate files for the bz2, gz and Z lsof distribution archives. The new files reside with the distribution archives and supplement the signature information already inside the archives.

Validated on Solaris 10, i8xpc, build s10\_63.

4.74 January 17, 2005

Fixed a Solaris segment fault bug on systems that lack a /dev/allkmem device. Offered the fix as a patch to lsof 4.73. The bug was reported by Donald Zoch <donald.zoch@amd.com>.

Updated lsof for FreeBSD 6.0 and higher for a change in <sys/vnode.h>, based on a report from Sergey A. Osokin <osa@FreeBSD.ORG>. Made the update available in a 4.74 'A' edition pre-release.

Filed an HP bug report about missing pstat(2) CWD info for LOFS on HP-UX 11.11 and higher. The missing CWD info was noticed by Ermin Borovac <e.borovac@bom.gov.au>. Added info to 00FAQ about the problem, which can cause the lsof test suite's LTbasic test to fail.

Updated the q4-generated tcp\_s.h in the lsof distribution and added socket option support for HP-UX 11.00. Erwin Reynolds <ereyns@europarl.eu.int> helped test.

Updated for Solaris 10, build s10\_69, with a patch

supplied by Mike Miscevic <miscevic@hotpop.com>.

Added v\_path support to Solaris 10 lsof. That relieves it of having to read and decode the kernel DNLC, and delivers full paths more reliably.

Added specialized NFS4 support to Solaris 10 lsof.

Applied Solaris 10 patches to lsof supplied by Casper Dik <casper@holland.sun.com>.

Updated lsof for NetBSD 2.99.10 and tested it on a system provided by Andrew Brown <atatat@atatat.net>.

Added support for the FreeBSD 6.0-CURRENT f\_vnode pointer in the file structure.

Added BSDI, FreeBSD, NetBSD and OpenBSD support for the \*effnlink member of the inode structure. This makes the lsof LTnlink test run faster on all modified dialects and correctly on OpenBSD.

Added ptys support for NetBSD, using modifications provided by Andrew Brown.

Changed the netbsd Configure stanza to look by default for system header files in both /usr/include and /usr/src. (The NETBSD\_SYS environment variable can still be used to select an alternate for /usr/src.)

Corrects two FreeBSD 4.10 RPC/XDR type definitions.

Added an FAQ Q&A about setuid and setgid restrictions in HP-UX 11.11. The information in the answer was supplied by Frank Sanders <frank.sanders@siemens.com>.

Added abbreviations for AXI FCIO and FSNAPSHOT file flags. Holger VanKoll <Holger.VanKoll@swisscom.com> reported the missing FCIO.

Adjusted lsof's private AIX 64 bit rnode structure for 64 bit AIX 5.2 systems. (IBM doesn't distribute a correct <nfs/rnode.h> for it.)

Corrected a Linux socket inode printing bug reported by Igor Schein <igor@txc.com>.

Updated for FreeBSD 4.11. The support compiles but hasn't been tested.

Back-ported a FreeBSD 6.0-CURRENT fix to FreeBSD 5.3-RELEASE-p1. That was done to solve a compilation problem reported by Radko Keves <rado@daemon.sk>.

4.75 May 16, 2005

Dropped the *\*claim\** that lsof works on DEC OSF/1 and Digital UNIX, since my last 4.0 test system has been removed. The last tested distribution of lsof on DEC OSF/1 and Digital UNIX was revision 4.74. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

Added negation forms to the values in the -g (PGID) and -p (PID) lists. Negated PGID and PID values, like negated UID or login name values, are applied without ORing or ANDing and take effect before any other selection criteria are applied.

At the request of Marcin Gozdalik <gozdal@gmail.com> added a -X option for Linux. The option inhibits the reading of the /proc/net/tcp\* and /proc/net/udp\* files.

Based on a report from David Gutierrez <davegu1@hotmail.com> changed DEC OSF/1 process table allocation to request memory in smaller increments.

Based on a report from jayjwa <jayjwa@atr2.ath.cx> updated the Customize script to use "tail -n 1" where possible.

Enabled support for FreeBSD 5.4.

Improved the BSDI, FreeBSD, NetBSD, OpenBSD and Solaris kvm\_open() and kvm\_openfiles() error messages.

Enabled support for NetBSD 2.99.12.

Improved HP-UX Configure stanza with help from Piet Starreveld <pstarrev@csc.com>. Picked some lint Piet found.

Enabled IPv6 support for HP-UX > 11. Piet Starreveld helped test it on 11.23, among others.

Updated for HP-UX 11.23 on the ia64 architecture.

Updated to latest FreeBSD 6.0-CURRENT, using a test system provided by Andrzej Tobola <ato@iem.pw.edu.pl>.

Added support for SCO OSR 6.0.0 and UnixWare 7.1.4 with help from Richard at SCO.

Corrected a Linux bug in NFS handling, reported by Karel Zak <kzak@redhat.com>. Karel supplied a patch.

Improved the code for accessing an AIX 3.2 and higher sockaddr\_un structure, thus eliminating a segmentation fault possibility.

Updated for AIX 5.3.

Added preliminary (DEBUG) support for the AIX SANFS file system.

Fixed a bug in the Solaris 10 processing of the vnode's v\_path pointer with code supplied by Edward Jajko <ejajko@portal.com>. The fix was offered as a patch to 4.74.

Dropped support for OpenUNIX 8, since a test system is no longer available. Archived an OpenUNIX-only distribution of the last revision (4.74) tested on OpenUNIX in pub/tools/unix/Isos/OLD/src.

Tested under Openbsd 3.7.

Tested under Darwin 7.7.0.

Enabled building on amd64 Solaris 10 with hints from Marc Aurele La France <tsi@ualberta.ca>. Marc provided a test system.

Supplied a missing quote in the FreeBSD Configure stanza. Carl Cook <Info@quantum-sci.com> reported the problem.

Removed "-O" option from tests/Makefile so that the HP-UX bundled compiler won't complain.

4.76 August 30, 2005

Corrected an example and spelling errors in man page.

Updated for Apple Darwin 8.x with changes supplied by Allan

Nathanson <ajn@apple.com>. Allan also provided a test system.

Completed documentation of CLRLFILEADD in all machine.h files.

At the request of Chris Markle <cmarkle@sendmail.com> added partial listen queue length to socket options displayed when -Tf is specified. Partial queue length is not reported for all dialects. (00FAQ lists the ones where it is reported.)

Updated for FreeBSD 7.0 with information supplied by Andrzej Tobola <ato@iem.pw.edu.pl>.

Updated Solaris VxFS support for VxFS versions 4 and above with technical advice from Craig Harmer <craig\_harmer@symantec.com>, Gary Millen <gary\_millen@symantec.com> and Chuck Silvers <charles\_silvers@symantec.com>. Testing help was provided by Michael Antlitz <mantlitz@prophasys.com>, Steve Ginsberg <steve@dhapdigital.com> and Kenneth Stailey <kstailey@yahoo.com>.

Fixed a Solaris address space map processing bug. Janardhan Molumuri <mjanardhan@gmail.com> reported the bug and help me identify it. Made the fix available as a patch to 4.75.

Added support for Solaris 10 port and CTFS files. The CTFS support is incomplete, because I don't know how to get inode number, size and link count. (There's a new 00FAQ entry about that.)

Investigated a report from Christopher J Warweg <warwegc@GAO.GOV> that the CHECKSUMS for the lsof 4.75 binary for 64 bit Solaris 8 was incorrect. It was my packaging error. I rebuilt and repackaged the binary.

Enabled support for Linux map file names with embedded spaces.

4.77 April 10, 2006



Added -X option support for Solaris 10 and above. When -X is specified lsof will report cached v\_node path names for unlinked files, followed by "(deleted)". Improved cached vnode path name handling by adding "(?)" to the end of path names of questionable accuracy. Updated 00FAQ to reflect these changes.

Updated for FreeBSD 7.0-CURRENT.

Fixed name addition spacing bug, reported by Stuart Anderson <anderson@ligo.caltech.edu>. Also updated Solaris 10 SAMFS support at Stuart's request.

Added missing "break;" and another HASSTATVFS test to the NetBSD and OpenBSD dnode.c. Bill Behr <bbeh@networkstoragecorp.com> reported those needs.

Fixed an HP-UX 11 file descriptor "chunk" size problem, reported by Per Allansson <per@appgate.com>. Per helped devise the fix and tested it. This fix was offered as a patch to lsof 4.76.

Updated for FreeBSD 6.0-STABLE and FreeBSD 6.1-PRERELEASE.

Updated scripts/sort\_res.perl5 with changes supplied by Frederick Fabian <fabian.frederick@skynet.be>, the author of the script.

Corrected +/-M man page documentation error, reported by Roger Cornelius <rac@tenzing.org>.

Improved FreeBSD user device random seed generation in response to a problem report from Danny Braniss <danny@cs.huji.ac.il>.

Eliminated three syntax error bugs and other compiler complaints from the PSTAT-based lsof. H. Merijn Brand <h.m.brand@xs4all.nl> reported the problems and tested the fixes.

Eliminated compiler complaints in the test suite.

Investigated problems with the building of lsof on PA-RISC HP-UX 11.23, based on a report from John Orndorff <John.Orndorff@sungard.com>. Found that

neither the HP bundled C compiler nor gcc would build lsof, but the the HP unbundled ANSI C compiler would. Concluded that HP bundled C compiler can't handle <gssapi/gssapi.h>. Devised a work-around to gcc's omission of the rpcnt structure definition of <netdb.h> that allows it to compile lsof's print.c, but the resulting binary doesn't run reliably. Documented the situation in 00FAQ.

Changed reporting of unknown file types. The number of an unknown type is now reported as four octets. The change was made in response to a Linux lsof bug report from Karel Zak <kzak@redhat.com>.

Dropped the \*claim\* that lsof works on BSDI BSD/OS since my last test system has been removed. The last tested distribution of lsof for BSDI BSD/OS was revision 4.76. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

As a result of discussing the lsof source tar's MD5 checksum with Andrew Bell <andrew.bell.ia@gmail.com>, changed the description of a suitable MD5 tool in the lsof distribution's documentation to name the openssl "dgst" command.

Enabled compilation on Solaris 10 1/06 with a fix sent by Jason Fortezzo <fortezza@mechanicalism.net>. Made the fix available as a patch to 4.76.

Adjusted to FreeBSD 5.5-PRERELEASE.

Corrected a bug in the lsof library's process\_file() function to enable the locating of AIX XTI sockets by their TCP/IP address values. The bug was reported by Michel Dubois <Dubois@sears.ca>.

Based on a bug report from Karel Zak <kzak@redhat.com> added command name length checking to as many dialects as possible (Linux for Karel) for the "-c c" option.

Updated for OpenBSD 3.[89]. Tested the 3.9 update on a system provided by David Mazieres. I have not tested on OpenBSD 3.8, but David reports lsof 4.76 worked there.

Ended regression testing of lsof on 32 bit Solaris 8 with the ending of access to a test system. Lsof continues to be tested on 64 bit Solaris 8.

4.78 April 24, 2007

Added more information to the lsof FAQ about missing link counts and sizes on Linux files.

Simplified Linux stat() and lstat() usage.

Relocated #define's that prevent OpenBSD compilation on systems without a /proc file system. Pieter Bowman <bowman@math.utah.edu> reported the problem.

Added code to avoid processing Linux /proc/<PID>/maps file entries with zero device and node numbers. Some such entries now have names associated with them that are not path names -- e.g., "[heap]", "[stack]" or "[vdso]". Scott Worley <sworley@chkno.net> reported lsof's mishandling of such entries.

Added SELinux security context support, provided by James Antill <james.antill@redhat.com>.

I have not tested this, but James and Karel Zak <kzak@redhat.com> have.

Added the #include of <sys/types.h> to Solaris lsof to enable compilation on Solaris 10 6/06. Peter Harvey Peter.Harvey@Sun.COM diagnosed the problem and supplied a patch.

Added better support for JFS2 on AIX 5.2 and 5.3, based on bug reports and help from Thomas Braunbeck <BRAUNBEC@de.ibm.com> and Tom Whitty <TWHITTY@cerner.com>.

Documented that lsof supports AIX 5.3 only up through maintenance level 1 (ML1).

Enabled Solaris lsof to locate the AFS vnode operation address for OpenAFS 1.4.1. The fix was supplied by Robert Jelinek <Robert.Jelinek@MorganStanley.com>.

Enabled support for Solaris 10 ZFS. If the necessary ZFS header files aren't found, lsof offers the option to drop ZFS support, to use internal, possibly inaccurate structure definitions, or to supply a path to the missing header files. Horst Scheuermann

<Horst.Scheuermann@uni-trier.de> provided a development system and helped test the support.

Corrected a typo in the man page, reported by Eric S. Raymond <esr@thyrsus.com>.

Changed the spelling of macroes to macros in lsof source and documentations files, based on a suggestion from Josh Soref <timeless@gmail.com> and verification with the OED.

The following dialects are no longer supported: 32 bit AIX 5.2, HP-UX 11, OpenStep 4.2, Solaris 2.6, Solaris 8, True Unix 64 and UnixWare 7.1.4. Lsof may work on them, but I no longer have test systems for them. Support for OpenBSD ends at its version 3.9 for lack of interest in the port.

4.79 April 15, 2008

\*\*\*\*\* IMPORTANT NOTE \*\*\*\*\*

\* \*  
\* Lsof support has been reduced to the following \*  
\* dialects: AIX, FreeBSD, Linux and Solaris, and \*  
\* only in selected versions of those dialects. \*  
\* The selected versions are listed in this file \*  
\* and in other lsof documentation.

\* \*  
\* I have made this move because of retirement \*  
\* and because I no longer have many test systems \*  
\* available to me. \*  
\* \*  
\* Vic Abell \*  
\* \*

\*\*\*\*\*

Fixed a Solaris VXFS permission problem when accessing the VXFS inode offsets. The bug was reported by Gregory A. Ivanov <ivga@mts.ru>. Gregory tested the fix.

Moved an #include <string.h> later in FreeBSD dlsof.h to enable compilation on recent FreeBSD releases. The change was supplied by Roy Marples <uberlord@gentoo.org>.

Improved Linux /proc file stream reading speed by applying

an expanded version of a patch from Eric Dumazet <dada1@cosmosbay.com> that allocates a page size buffer to each stream. Improved TCP, TCP6, UDP and UDP6 hashing by determining the hash bucket count from the /proc/net sockstat and sockstat6 files. The improvement was suggested by Eric and he provided sample code. Eric also tested both improvements.

Modified Configure script to build lsof on FreeBSD

6.2. Tested it on a system provided by Larry Rosenman <ler@lerctr.org>.

Fixed a Linux maps file processing bug that prevented path names from having an embedded colon. James Lingard <jchl@arastra.com> reported the bug and helped with its fix.

Based on reports from Eric Dumazet and Samuel Thibault <samuel.thibault@ens-lyon.org> added support for the Linux 2.6.22 kernel's /proc/<PID>/fdinfo files -- i.e., file offset and flags. Samuel Thibault provided a test system.

Fixed a Linux UNIX socket memory leak, reported by Phillip Shin <pshin@xceedium.com>. Phillip supplied the fix.

With generous assistance from HP added support for an HP-UX 11.23 patch that makes TLI/XTI socket address information available.

Fixed

a header file problem for FreeBSD 6.2 on the Alpha architecture. The problem was reported by Pekka Honkanen <phonkane@cc.hut.fi>. Pekka tested the fix.

Based on a report and using suggested fixes from Karel Zak <kzak@redhat.com>, made these changes to Linux lsof: corrected a getpidcon() error message; insured that inode numbers are handled correctly for their unsigned long long type; and improved SELinux handling. At the request of Alon Bar-Lev <alonbl@gentoo.org> added the LINUX\_HASSELINUX environment variable to enable or inhibit SELinux support unconditionally.

Updated Configure for FreeBSD 8.0-CURRENT and tested lsof on AMD64 there.

Added a patch provided by Oles Hnatkevych <don\_oles@able.com.ua> for FreeBSD systems where the root file system is on a CD9660 device.

Added compensation for the disappearance of FMARK and FDEFER from the FreeBSD 8.0-CURRENT <sys/file.h>.

Updated FreeBSD lsof with ZFS support. Larry Rosenman <ler@lerctr.org>, Erwin Lansing <erwin@FreeBSD.org>, Wesley Shields <wxs@atarininja.org> and Dmitry Morozovsky <marck@rinet.ru> provided test systems.

Fixed a socket file identification problem reported by Pavol Rusnak <stick@gk2.sk>. Pavol also reported the cause of the problem.

Added the ability to format the repeat mode marker line with strftime(3), where the dialect supports the localtime(3) and strftime(3) C library functions. The addition was suggested by Mike Depot <mdepot@comcast.net>, who also tested it. The addition required creating a new main lsof source module, util.c, that contains functions whose compilation conflicts with the general header file tree defined by lsof.h and dlsof.h.

Based on reports from Andrei V. Lavreniyuk <andy.lavr@reactor-xg.kiev.ua> and Pav Lucistnik <pav@FreeBSD.org> updated the FreeBSD 7.0 and above file lock handling to use new locking structures. The update requires a terrible hack to get a definition for the lock owner structure from a kernel source module into a local lsof header file.

4.80 May 12, 2008

Updated for a FreeBSD 7.0 and above byte level locking change. The problem was reported by Conrad J. Sabatier <conrads@cox.net>, who helped test the update. Wesley Shields <wxs@FreeBSD.org> provided an 8.0-CURRENT test system.

Propagated the FreeBSD 7.0 and above locking changes to FreeBSD 6.x, based on a report from Edwin Groothuis <edwin@FreeBSD.org>.

Added warnings for unsupported dialects or versions.

Added Linux support for the UDPLITE protocol. Eric Dumazet <dada1@cosmosbay.com> supplied a patch.

Added a missing quote to the Configure script's FreeBSD stanza.

Added a usage.o rule to the HP-UX PSTAT-based Makefile. I mistakenly deleted the rule at revision 4.79. The missing rule was reported by Kawaljeet Kaur <kawaljeet.malviya@gmail.com> who tested the corrected Makefile.

4.81 October 21, 2008

Updated the Darwin libproc sources with changes from Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc.

Changed dummy declarations in library source files to eliminate complaints about unused variables and empty object files. This change may not work on dialects I can no longer test; it has been tested on some versions of AIX, Darwin, FreeBSD, Linux and Solaris.

At the request of Hal Brooks <hal@uga.edu> added support for Linux /proc/net/packet files. Hal tested it.

Added socket file only performance enhancements to Linux and PSTAT-based HPUX lsof.

Added htonl call around improper usage of INADDR\_LOOPBACK; report from an Apple engineer forwarded by Allan Nathanson <ajn@apple.com>.

Adjusted for FreeBSD-8.0 change in device number handling. The adjustment should work for FreeBSD 5 and above, should the 8.0 change be propagated downward. The problem was reported by Pav Lucistnik <pav@FreeBSD.org>. An updated test system was provided by Erwin Lansing <erwin@FreeBSD.org>.

Reduced AIX support to version 5.3, since test systems with older versions are no longer available to me.

At the request of Marjo F. Mercado <mmercado@xceedium.com> and Phil Shin <pshin@xceedium.com> applied some speed improvements to lsof, particularly when the files of interest are /Internet files -- i.e., selected with lsof's

-i" option. Added a two new options to assist the improvements: 1) "-c^<command>" to tell lsof to exclude the named command(s); and 2) "-stcp|ud>:[^]state'" to tell lsof to include in its reporting or exclude (^) from its reporting Internet files in the named states (e.g., LISTEN, ^CLOSE\_WAIT, IDLE, etc.) For the most part these changes apply only to AIX, Darwin, FreeBSD, PSTAT-based HP-UX, Linux and Solaris, since those are the only places I could test them. They are controlled by the HASTCPUDPSTATE definition in each dialect's machine.h header file. Marjo and Phil provided HP-UX 11.23 and 11.31 test systems.

Fixed a stat(2) problem on HP-UX 11.31 while testing the speed improvements.

Adjusted for kernel header file changes in FreeBSD 8.0-CURRENT. Larry Rosenman <ler@lerctr.org> provided a test system.

Added a warning for Solaris systems where VxFS node info can't be obtained from the VxFS utility library. The warning was requested by Tom Matthews <Tom.MATTHEWS@rbs.com>.

Corrected mishandling of file system path name arguments that have trailing slashes, except, of course, the root file system, "/". Allan Nathanson <ajn@apple.com> reported the bug.

4.82 March 25, 2009

Corrected an over-zealous exclusion test that caused lsof to report nothing when it was given no arguments and built with HASSECURITY and HASNOSOCKSECURITY enabled. Joshua Kinard <kumba@gentoo.org> reported the bug and supplied information for reproducing it.

Based on a report from Dan Trinkle <trinkle@cs.purdue.edu> corrected use of <sys/utsname.h> for 32 bit Solaris 10 and above compilations. Simultaneously eliminated a casting complaint in arg.c and updated Configure to use the appropriate 64 bit compilation option (-xarch=v9 or -m64) with the Solaris Sun C compiler.

Updated for FreeBSD 7.1-PRERELEASE with information supplied by Larry Rosenman <ler@lerctr.org>.

Updated the Darwin libproc sources with changes from



Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc. Allan also provided many page corrections.

Updated the FreeBSD Makefile to use the `$(MAKE)` variable for ZFS `dnod2.c` module compilation, based on a suggestion from Alexis Ballier <aballier@gentoo.org>.

Improved the Solaris VxFS library location test, based on a suggestion from Jason Fortezzo <fortezza@mechanicalism.net>. Jason tested the change.

Updated Solaris 10 ZFS support for ZFS version 4 and ZFS pool version 10, using a test system kindly provided by Vladislav Nespov <vladislav.nespov@id.ethz.ch>.

Renata

Maria Dart <renata@slac.stanford.edu> tested on ZFS version 4, verifying that the update works there, too. (ZFS pool version 10 is apparently the ZFS version shipped with the 10/08 update to Solaris. The original ZFS support targeted ZFS version 3.)

I still consider ZFS support in Solaris `lsuf` a hack, because it depends on a `znode` structure definition that I developed using `dbx`. Sun is remiss in not distributing the ZFS header files used to build the distributed kernel.

Because of the `znode` structure definition hack, I can't guarantee that `lsuf` ZFS support will work for any other versions of ZFS.

Solaris 10: adjusted to a change in the way devices are stored in the kernel; fixed a problem in zone handling; and added rudimentary `sharedfs` support. Carson Gaspar <carson@taltos.org> reported the device number problem, provided a test system, and tested the changes. Peter Vines <psv2b@eservices.virginia.edu> reported the zone handling problem and tested the fix.

Adapted to FreeBSD 8.0-CURRENT changes in device number computation. Problem was reported by Erwin Lansing <erwin@FreeBSD.org>. Larry Rosenman <ler@lerctr.org> provided a test system.

Corrected Solaris `Configure` test for appropriate VxFS library when using `gcc` to compile `lsuf`.

Updated for loss of KAME IPv6 FreeBSD accommodations.

Adapted to FreeBSD 7.2. Made Configure script recognized FreeBSD 6.3.

4.83 January 18, 2010

Converted Solaris 10 and above ZFS support to use the CTF debugger library, libctf. Code was supplied by Robert Byrnes <Robert.Byrnes@deshaw.com>.

Corrected a typo in the testing of the LINUX\_HASSELINUX environment variable in the Configure script. The error was reported by Mike Frysinger <vapier@gentoo.org>. At Mike's request made Configure script accept LSOF\_RANLIB (ranlib command), LSOF\_CFGF (additional configuration flags) and LSOF\_CFGL (additional library specifications) from the environment.

Enabled compilation of Solaris 10 lsof after a recent Sun patch which changed the PC file system's structure. Peter Vernam <pvernam@draper.com> reported the problem and helped with the fix.

Made the sort of configuration CFLAGS in the CkTestDB script impervious to locale settings.

Ported to Solaris 11, using a test system kindly provided by David Day <dday76@gmail.com>.

Adjusted to the disappearance of <nfs/rpcv2.h> in FreeBSD 8.0-BETA1.

Changed Solaris node type lookup to a hashed method and added some ability for it to handle duplicate vnodeop names in /dev/ksyms.

Updated for FreeBSD 9.0-CURRENT. Andrzej Tobola <ato@iem.pw.edu.pl> provided a test system. Extends the fix to FreeBSD 6.0 and above via a Configure test and a compile-time definition. The need for the extension was reported by Erik Trulsson <ertr1013@student.uu.se>>

Made corrections to FAQ typographical errors, suggested by Josh Soref <timeless@gmail.com>.

Added

\_\_UCLIBC\_\_ test to Linux dlsof.h so lsof would compile on an Intel ARM XScale processor. The addition was provided by Doug Kehn <rdkehn@yahoo.com>.

Added test for <utmpx.h> to FreeBSD configuration. Improved its use in lsof.h. The changes were supplied by Martin Wilke <miwi@FreeBSD.org>.

4.84 July 29, 2010

Fixed a man page nroff command error with a correction supplied by Josh Soref <timeless@gmail.com>.

Made Configure script recognize FreeBSD 7.3. Larry Rosenman <ler@lerctr.org> provided a test system.

Improved task support, initially for Linux only, with help provided by Jerome Marchand <jmarchan@redhat.com> and Miklos Szeredi <mszeredi@suse.cz>. The support includes a new compile-time definition, HASTASKS, and a new run time option, "-K" to select task reporting.

While adding help output support for "-K", reorganized the printing of help columns to make it much easier to add a new option description.

Updated the Solaris PC file system structure patch in revision 4.83 so it will compile with gcc.

Disabled the Solaris lgrp\_root work-around in the Solaris machine.h so it won't cause compilation problems on Solaris 11. It no longer causes compilation problems on my Solaris 9 and 10 test systems, but some older Solaris 9 and 10 versions may still need it, so the work-around was left in the Sun machine.h and a FAQ entry was created about it.

Updated for Solaris 11 b134, using a test system kindly provided by Carson Gaspar <carson@taltos.org>. Made provisions for the next ZFS version. Added info about the failure of the LTnlink test on ZFS file systems.

Corrected typo in Configure script, reported by Dmitry Berezin <dmitryb@oit.rutgers.edu>.

4.85 September 27, 2011

John Dzuberka <Zube@CS.ColoState.EDU> kindly provided a patched Solaris 9 test system with the lgrp\_root conflict and I was able to devise an automatic work-around for the conflict. The

special note in ../dialects/sun/machine.h  
was removed and  
the 17.28.1 FAQ entry was modified to reflect the update.

Added a Solaris 11 work-around for a typedef problem with  
<sys/mutex.h>. Carson Gaspar <carson@taltos.org> reported  
the problem and supplied the work-around.

Added support for FreeBSD 7.4 and 8.2; tested on systems  
provided by Larry Rosenman <ler@lerctr.org>.

Added support for 32 bit Solaris 11 lsof with mods supplied  
by Jan Wortelboer <J.H.P.Wortelboer@uva.nl>.

Added Solaris 11 support for using an alternate genunix  
location. Bill Goodridge <bill@its.brooklyn.cuny.edu>  
reported the alternate location.

Added further Linux cross configuration support to lsof's  
Configure script. The additional support was supplied by  
Grant Erickson <erick205@umn.edu>. See the descriptions of  
the LINUX\_\* environmen variables in 00XCONFIG for more  
information. Tested lsof on Linux kernel 2.6.32 and picked  
some lint that surfaced during the test.

Added fixes and changes  
for Apple Mac OS X 10.6, provided by  
Allan Nathanson <ajn@apple.com>. Allan also provided a test  
system.

Tested on FreeBSD 6.4 i386, using a test system provided by  
Terry Kennedy <TERRY@tmk.com>. Updated for recent FreeBSD ZFS  
changes on an 8.2 amd64 test system also provided by Terry.

Changed documentation to indicate FreeBSD 7.x is no longer  
supported, since I no longer have a test system.

Made some changes to the lsof man page, suggested by Navid  
<evilm4chine@googlemail.com>.

Added compensation for Solaris 10 systems that have patch  
144488-10. The patch requires that the new header file  
<sys/socket\_proto.h> be included while \_KERNEL is defined.  
Brett Bartick <Brett.bartick@nomura.com> reported the problem  
first, followed by Stuart Anderson <anderson@ligo.caltech.edu>.  
Michael Hocke <michael.hocke@nyu.edu> suggested a work-around  
which I refined to limit it to the specific Solaris 10 instance  
and then tested on a system provided by Charles

Stephens  
<cfs@cowlabs.com>

Added the +|-e option for Linux. It exempts file systems named by path from function calls that might block in the kernel -- i.e., stat(2) and lstat(2), and when the +e form is used, readlink (2). The new packager of lsof for the Linux Fedora and RHEL distributions, Peter Schiffer <pschiffe@redhat.com>, asked for the feature so it could be used with Clearcase file systems, whose implementation can block stat(2) calls. I consider this feature very risky and easy to misuse -- e.g., specifying the file system as '/' would exempt all file systems. I don't intend to propagate this option to any other UNIX dialect that lsof currently supports.

Made FreeBSD 9 adjustment.

Fixed a Linux bug that prevented the display of paths for abstract UNIX sockets. Masatake Yamato <yamato@redhat.com> reported the bug and supplied a patch.

Added compensation for the removal of RPC header files from Glibc 2.14 for Linux. Marek Behun <kabel@blackhole.sk> reported the problem and supplied a patch.

Added support for Linux Netlink protocol. Masatake Yamato requested the support and supplied a patch. Peter Schiffer <pschiffe@redhat.com> provided a test system.

Corrected Linux UDP6-lite path. The error was reported by Masatake Yamato and he also supplied a patch.

Vic Abell <abe@purdue.edu>  
September 27, 2011

Found in path(s):  
\* /opt/cola/permits/1550988360\_1675319900.3624527/0/lsof-4-85-zip/00DIST  
No license file was found, but licenses were detected in source scan.

Making and Installing lsof 4

```

| The latest release of lsof is always available via anonymous ftp |
| from lsof.itap.purdue.edu. Look in pub/tools/unix/lsof. |

```

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=====  
Pre-built Lsof Binaries  
=====

Avoid using pre-built Lsof binaries if you can; build your own instead.

I do not support Lsof binaries built and packaged by third parties nor Lsof binaries built from anything but the latest Lsof revision. (See the Bug Reports section for more information on the details of Lsof support.)

One important reason for those support restrictions is that when Lsof is built its Configure script tunes Lsof to the features available on the building system, often embodied in supporting header files and libraries. If the building system doesn't have support for a particular feature, Lsof won't be built to support the feature on any system.

The Veritas VxFS file system is a good example of a feature that requires build-time support.

UNIX dialect version differences -- Solaris 8 versus 9, AIX 4.3.3 versus 5.2, etc. -- can also render a pre-built Lsof binary useless on a different version. So can kernel bit size.

There are so many potential pitfalls to using an Lsof binary improperly that I strongly recommend Lsof be used only where it is built.

=====  
Making Lsof  
=====

```
$ cd <Lsof source directory>
$./Configure <your dialect's abbreviation>
```

\$ make

(Consult the 00FAQ and 00XCONFIG files of the lsof distribution for information about using make command invocations and environment variables to override lsof default Makefile strings.)

This lsof distribution can be used with many UNIX dialects. However, it must be configured specifically for each dialect. Configuration is done in three ways: 1) by changing definitions in the machine.h header file of the UNIX dialect of interest; 2) by defining environment variable values prior to calling Configure (see the 00XCONFIG file, the Environment Variables and Environment Variables Affecting the Configure Script sections of this file); and 3) by running the Configure shell script found in the top level of the distribution directory.

You may not need to change any machine.h definitions, but you might want to look at them anyway. Pay particular attention to the definitions that are discussed in the Security section of this file. Please read that section.

The Configure script calls three other scripts in the lsof distribution: AFSConfig; Inventory; and Customize. The AFSConfig script is called for selected dialects (AIX, HP-UX, NEXTSTEP, and Solaris) to locate AFS header files and determine the AFS version. See The AFSConfig Script section of this file for more information.

The Inventory script checks the completeness of the lsof distribution. Configure calls Inventory after it has accepted the dialect abbreviation, but before it configures the top-level directory for the dialect. See The Inventory Script section of this file for more information.

Configure calls the Customize script after it has configured the top-level lsof directory for the declared dialect. Customize helps you modify some of the important compile-time definitions of machine.h. See the The Customize Script section.

You should also think about where you will install lsof and its man page, and whom you will let execute lsof. Please read the Installing Lsof section of this file for information on installation considerations.

Once you have inspected the machine.h file for the dialect for which you want to build lsof, and made any changes you need, run



the Configure script, supplying it with the abbreviation for the dialect. (See the following table.) Configure selects the appropriate options for the dialect and runs the Mksrc shell script in the dialect sub-directory to construct the appropriate source files in the top-level distribution directory.

Configure may also run the MkKernOpts script in the dialect sub-directory to propagate kernel build options to the dialect Makefile. This is done for only a few dialects -- e.g., DC/OSx, and Reliant UNIX.

Configure creates a dialect-specific Makefile. You may want to inspect or edit this Makefile to make it conform to local conventions. If you want the Makefile to install lsof and its man page, you will have to create an appropriate install rule.

Lsof may be configured using UNIX dialect abbreviations from the following table. Alternative abbreviations are indicated by a separating `|'. For example, for SCO OpenServer you can use either the `osr' or the `sco' abbreviation:

```
$ Configure osr
or
$ Configure sco
```

#### Abbreviations UNIX Dialect

-----

aix	IBM AIX 5.[23] and 5.3-ML1 using IBM's C Compiler
aixgcc	IBM AIX 5.[12] and 5.3-ML1 using gcc
darwin	Apple Darwin 7.x and 8.x for Power Macintosh systems
decosf	DEC OSF/1, Digital UNIX, Tru64 UNIX 4.0 and 5.1
digital_unix	Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
du	Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
freebsd	FreeBSD 4.x, 4.1x, 5.x and [67].x
hpux	HP-UX 11.00, 11.11 and 11.23, using HP's C Compiler, both /dev/kmem-based and PSTAT-based
hpuxgcc	HP-UX 11.00, 11.11 and 11.23, using gcc, both /dev/kmem-based and PSTAT-based
linux	Linux 2.1.72 and above for x86-based systems
netbsd	NetBSD 1.[456], 2.x and 3.x
next	NEXTSTEP 3.[13]
nextstep	NEXTSTEP 3.[13]
ns	NEXTSTEP 3.[13]
nxt	NEXTSTEP 3.[13]
openbsd	OpenBSD

2.[89] and 3.[0-9]  
openstep OPENSTEP 4.x  
os OPENSTEP 4.x  
osr SCO OpenServer Release 5.0.6, using the C compiler  
from the SCO developer's kit  
osrgcc SCO OpenServer Release 5.0.6, using gcc  
osr6 SCO Openserver 6.0.0, using the SCO C compiler  
sco SCO OpenServer Release 5.0.6, using the C compiler  
from the SCO developer's kit  
scogcc SCO OpenServer Release 5.0.6, using gcc  
solaris Solaris 2.x, 7, 8, 9 and 10 using gcc  
solarisc Solaris 2.x, 7, 8, 9 and 10 using Sun's cc  
tru64 Tru64 UNIX, DEC OSF/1, Digital UNIX 4.0 and 5.1  
unixware SCO|Caldera UnixWare 7.1.4  
uw SCO|Caldera UnixWare 7.1.4

If you have an earlier version of a dialect not named in the above list, lsof may still work on your system. I have no way of testing that myself. Try configuring for the named dialect -- e.g., if you're using Solaris 2.1, try configuring for Solaris 2.5.1.

After you have configured lsof for your UNIX dialect and have selected options

via the Customize script (See the The Customize Script section.) , use the make command to build lsof -- e.g.,

```
$ make
```

#### Other Configure Script Options

=====

There are three other useful options to the Configure script besides the dialect abbreviation:

-clean may be specified to remove all traces of a dialect configuration, including the Makefile, symbolic links, and library files.

-h may be specified to obtain a list of  
-help Configure options, including dialect abbreviations.

-n may be specified to stop the Configure script from calling the Customize and Inventory scripts.

Caution: -n also suppresses the AFSConfig

step.

## Environment Variables

=====

Lsof configuration, building, and execution may be affected by environment variable settings. See the Definitions That Affect Compilation section in the 00PORTING file, the General Environment Variables section in the 00XCONFIG file, the Dialect-Specific Environment Variables section in the 00XCONFIG file, and the Environment Variables Affecting the Configure Script section of this file for more information.

Note in the General Environment Variables section of the 00XCONFIG file that there are five environment variables that can be used to pre-define values in lsof's -v output: LSOF\_BLDCMT, LSOF\_HOST, LSOF\_LOGNAME, LSOF\_SYSINFO, and LSOF\_USER.

## Security

=====

If the symbol HASSECURITY is defined, a security mode is enabled, and lsof will allow only the root user to list all open files.

Non-root users may list only open files whose processes have the same user ID as the real user ID of the lsof process (the one that its user logged on with).

However, if HASNOSOCKSECURITY is also defined, anyone may list anyone else's open socket files, provided their listing is enabled with the "-i" option.

Lsof is distributed with the security mode disabled -- HASSECURITY is not defined. (When HASSECURITY is not defined, the definition of HASNOSOCKSECURITY has no meaning.) You can enable the security mode by defining HASSECURITY in the Makefile or in the machine.h header file for the specific dialect you're using -- e.g. dialects/aix/machine.h.

The Customize script, run by Configure when it has finished its work, gives you the opportunity to define HASSECURITY and HASNOSOCKSECURITY. (See the The Customize Script section.)

The lsof -h output indicates the state HASSECURITY and HASNOSOCKSECURITY

had when lsof was built, reporting:

```
"Only root can list all files;"
if HASSECURITY was defined and HASNOSOCKSECURITY wasn't
defined;
```

```
"Only root can list all files, but anyone can list socket files."
if HASSECURITY and HASNOSOCKSECURITY were both defined;
```

```
"Anyone can list all files;"
if HASSECURITY wasn't defined. (The definition of
HASNOSOCKSECURITY doesn't matter when HASSECURITY isn't
defined.)
```

You should carefully consider the implications of using the default security mode.

When lsof is compiled in the absence of the HASSECURITY definition, anyone who can execute lsof may be able to see the presence of all open files. This may allow the lsof user to observe open files -- e.g., log files used to track intrusions -- whose presence you would rather not disclose.

All pre-compiled binaries on [lsof.itap.purdue.edu](http://lsof.itap.purdue.edu) and mirrored from it were constructed without the HASSECURITY definition.

As distributed, lsof writes a user-readable and user-writable device cache file in the home directory of the real user ID executing lsof. There are other options for constructing the device cache file path, and they each have security implications.

The 00DCACHE file in the lsof distribution discusses device cache file path construction in great detail. It tells how to disable the various device cache file path options, or how to disable the entire device cache file feature by removing the HASDCACHE definition from the dialect's machine.h file. There is also information on the device cache file feature in the 00FAQ file. (The 00DCACHE and 00FAQ files are part of the lsof distribution package.)

The Customize script, run by Configure after it has finished its work, gives you the opportunity to change the compile-time options related to the device cache file. (See The Customize Script section.)

Since lsof may need setgid or setuid-root permission (See the Setgid Lsof Dialects and Setuid-root Lsof Dialects sections.), its security should always be viewed with skepticism. Lest the setgid and setuid-root permissions allow lsof to read kernel name list or

memory files, declared with the -k and -m options, that the lsof user can't normally access, lsof uses access(2) to establish its real user's authority to read such files when it can't surrender its power before opening them. This change was added at the suggestion of Tim Ramsey.

Lsof surrenders setgid permission on most dialects when it has gained access to the kernel's memory devices. There are exceptions to this rule, and some lsof implementations need to run setuid-root. (The Setgid Lsof Dialects and Setuid-root Lsof Dialects sections contains a list of lsof implementations and the permissions recommended in the distribution's Makefiles.)

The surrendering of setgid permission is controlled by the WILLDROPGID definition in the dialect machine.h header files.

In the end you must judge for yourself and your installation the risks that lsof presents and restrict access to it according to your circumstances and judgement.

#### Run-time Warnings

=====

Lsof can issue warning messages when it runs -- e.g., about the state of the device cache file, about an inability to access an NFS file system, etc. Issuance of warnings are enabled by default in the lsof distribution.

Issuance of warnings may be disabled by default by defining WARNINGSTATE in the dialect's machine.h. The Customize script may also be used to change the default warning message issuance state. (See The Customize Script section.)

The ``-w" option description of the ``-h" option (help) output will indicate the default warning issuance state. Whatever the state may be, it can be reversed with ``-w".

#### Device Access Warnings

=====

When lsof encounters a /dev (or /devices) directory, one of its sub-directories, or one of their files that it cannot access with opendir(3) or stat(2), it issues a warning message and continues. Lsof will be more likely to issue such a warning when it has been

installed with `setgid(<some group name>)` permission; it won't have trouble if it has been installed with `setuid(root)` permission or is being run under the root login.

The `lsof` caller can inhibit or enable the warning with the `-w` option, depending on the issuance state of run-time warnings. (See the Run-time Warnings section.)

The warning messages do not appear when `lsof` obtains device information from a device cache file that it has built and believes to be current or when warning message issuance is disabled by default. (See the "Caches -- Name and Device" section for more information on the device cache file.)

The `lsof` builder can inhibit the warning by disabling the definition of `WARNDEVACCESS` in the dialect's `machine.h` or disable all warnings by defining `WARNINGSTATE`. `WARNDEVACCESS` is defined by default for most dialects. However, some dialects have some device directory elements that are private -- e.g., HP-UX -- and it is more convenient for the `lsof` user if warning messages about them are inhibited.

Output from `lsof's -h` option indicates the status of `WARNDEVACCESS`. If it was defined when `lsof` was compiled, this message will appear:

```
/dev warnings = enabled
```

If `WARNDEVACCESS` was not defined when `lsof` was compiled, this message will appear instead:

```
/dev warnings = disabled
```

The `Customize` script, run by `Configure` after it has finished its work, gives you the opportunity to change the `WARNDEVACCESS` definition. (See The `Customize Script` section.)

## NFS

### Blocks

```
=====
```

`lsof` is susceptible to NFS blocks when it tries to `lstat()` mounted file systems and when it does further processing -- `lstat()` and `readlink()` -- on its optional file and file system arguments.

`lsof` tries to avoid being stopped completely by NFS blocks by doing the `lstat()` and `readlink()` functions in a child process, which returns the function response via a pipe. The `lsof` parent limits

the wait for data to arrive in the pipe with a SIGALRM, and, if the alarm trips, terminates the child process with a SIGINT and a SIGKILL.

This is as reliable and portable a method for breaking NFS deadlocks as I have found, although it still fails under some combinations of NFS version, UNIX dialect, and NFS file system mount options. It generally succeeds when the "intr" or "soft" mount options are used; it generally fails when the "hard" mount option is used.

When lsof cannot kill the child process, a second timeout causes it to stop waiting for the killed child to complete.

While the second timeout allows lsof to complete, it may leave behind a hung child process. Unless warnings are inhibited by default or with the -w option, lsof reports the possible hung child.

NFS block handling was updated with suggestions made by Andreas Stolcke. Andreas suggested using the alternate device numbers that appear in the mount tables of some dialects when it is not possible to stat(2) the mount points.

The -b option was added to direct lsof to avoid the stat(2) and readlink(2) calls that might block on NFS mount points and always use the alternate device numbers. If warning message issuance is enabled and you don't want warning messages about what lsof is doing, use the -w option, too.

The -O option directs lsof to avoid doing the potentially blocking operations in child processes. Instead, when -O is specified, lsof does them directly. While this consumes far less system overhead, it can cause lsof to hang, so I advise you to use -O sparingly.

## Caches

-- Name and Device

=====

Robert Ehrlich suggested that lsof obtain path name components for open files from the kernel's name cache. Where possible, lsof dialect implementations do that. The -C option inhibits kernel name cache examination.

Since AFS apparently does not use the kernel's name cache, where lsof supports AFS it is unable to identify AFS files with path name components.

Robert also suggested that lsof cache the information it obtains

via stat(2) for nodes in /dev (or /devices) to reduce subsequent running time. Lsof does that, too.

In the default distribution the device cache file is stored in .lsof\_hostname, mode 0600, in the home directory of the login of the user ID that executes lsof. The suffix, hostname, is the first component of the host's name returned by gethostname(2). If lsof is executed by a user ID whose home directory is NFS-mounted from several hosts, the user ID's home directory may collect several device cache files, one for each host from which it was executed.

Lsof senses accidental or malicious damage to the device cache file with extensive integrity checks, including the use of a 16 bit CRC. It also tries to sense changes in /dev (or /devices) that indicate the device cache file is out of date.

There are other options for forming the device cache file path. Methods the lsof builder can use to control and employ them are documented in the separate 00DCACHE file of the lsof distribution.

#### Raw Sockets

=====

On many UNIX systems raw sockets use a separate network control block structure. Display of files for applications using raw sockets -- ping, using ICMP, for example -- need special support for displaying their information. This support is so dialect-specific and information to provide it so difficult to find that not all dialect revisions of lsof handle raw sockets completely.

#### Other Compile-time Definitions

=====

The machine.h and dlsof.h header files for each dialect contains definitions that affect the compilation of lsof. Check the Definitions That Affect Compilation section of the 00PORTING file of the lsof distribution for their descriptions. (Also see The Customize Script section.)

#### The AFSCONFIG Script

=====

Lsof supports AFS on some combinations of UNIX dialect and AFS



version. See the AFS section of this document for a list of supported combinations.

When configuring for dialects where AFS is supported, the Configure script calls the AFSCfg script to determine the location of AFS header files and the AFS version. Configure will not call AFSCfg, even for the selected dialects, unless the file /usr/vice/etc/ThisCell exists.

The AFS header file location is recorded in the AFSHeaders file; version, AFSVersion. Once these values have been recorded, Configure can be told to skip the calling of AFSCfg by specifying its (Configure's) -n option.

### The Inventory Script

=====

The lsof distribution contains a script, called Inventory, that checks the distribution for completeness. It uses the file 00MANIFEST in the distribution as a reference point.

After the Configure script has accepted the dialect abbreviation, it normally calls the Inventory script to make sure the distribution is complete.

After Inventory has run, it creates the file ".ck00MAN" in the top-level directory to record for itself the fact that the inventory has been checked. Should Inventory be called again, it senses this file and asks the caller if another check is in order, or if the check should be skipped.

The -n option may be supplied to Configure to make it bypass the calling of the Inventory script. (The option also causes Configure to avoid calling the Customize script.)

The lsof power user may want to define (touch) the file ".neverInv". Configure avoids calling the Inventory script when ".neverInv" exists.

### The Customize Script

=====

Normally when the Configure script has finished its work, it calls another shell script in the lsof distribution called Customize.

(You can tell Configure to bypass Customize with its -n option.)

Customize leads you through the specification of these important compile-time definitions for the dialect's machine.h header file:

HASDCACHE device cache file control  
HASENVDC device cache file environment  
variable name  
HASPERSDC personal device cache file path  
format  
HASPERSDCPATH name of environment variable that  
provides an additional component  
of the personal device cache file  
path  
HASSYSDC system-wide device cache file path  
HASKERNIDCK the build-time to run-time kernel  
identity check  
HASSECURITY the security option  
HASNOSOCKSECURITY the open socket listing option whe  
HASSECURITY is defined  
WARNDEVACCESS /dev (or /devices) warning message  
control  
WARNINGSTATE warning message issuance state

The Customize script accompanies its prompting for entry of new values for these definitions with brief descriptions of each of them. More information on these definitions may be found in this file or in the 00DCACHE and 00FAQ files of the lsof distribution.

You don't need to run Customize after Configure. You can run it later or you can edit machine.h directly.

The -n option may be supplied to Configure to make it bypass the calling of the Customize script. (The option also causes Configure to avoid calling the Inventory script.)

The lsof power user may want to define (touch) the file ".neverCust". Configure avoids calling the Customize script when ".neverCust" exists.

Customize CAUTION: the Customize script works best when it is applied to a newly configured lsof source base -- i.e., the machine.h header file has not been previously modified by the Customize script. If you have previously configured lsof, and want to rerun the Customize script, I recommend you clean out the previous configuration and create a new one:

```
$ Configure -clean
$ Configure
<dialect_abbreviation>
...
Customize in response to the Customize script prompts.
```

#### Cautions

=====

Lsof is a tool that is closely tied to the UNIX operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version, and even within a version as vendor patches are applied.

DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER. VENDOR PATCHES INFLUENCE THE VERSION IDENTITY.

On some UNIX dialects lsof versions may be even more restricted by architecture type.

The bottom line is use lsof where you built it. If you intend to use a common lsof binary on multiple systems, make sure all systems run exactly the same OS version and have exactly the same patches.

#### Warranty

=====

Lsof is provided as-is without any warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

The entire risk as to the quality and performance of lsof is with you. Should lsof prove defective, you assume the cost of all necessary servicing, repair, or correction.

#### License

=====

Lsof has no license. Its use and distribution are subject to these terms and conditions, found in each lsof source file. (The copyright year in or format of the notice may vary slightly.)

/\*

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\*  
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\*/

## Bug Reports

=====

Now that the obligatory disclaimer is out of the way, let me hasten to add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND BUG REPORTS ABOUT LSOF TO THE UNIX DIALECT OR DIALECT OPTION VENDOR.

At worst such bug reports will confuse the vendor; at best, the vendor will forward the bug report to me.

PLEASE DON'T SEND BUG REPORTS  
ABOUT LSOF BINARIES BUILT OR DISTRIBUTED  
BY SOMEONE ELSE, BECAUSE I CAN'T SUPPORT THEM.

I do support binaries I built, obtained ONLY from lsof.itap.purdue.edu. Before reporting a problem with a lsof.itap.purdue.edu binary, please verify the correctness of the signatures found in its associated

CHECKSUMS file.

Before you send me a bug report, please do these things:

- \* Make sure you try the latest lsof revision.

- + Download the latest revision from:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof`

- + Verify the signatures of what you have downloaded;

- + While connected to `lsof.itap.purdue.edu`, check for patches:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/patches`

- + If patches exist, install them in the latest revision you just downloaded. Then build the latest revision and see if it fixes your bug.

- \* If you're having trouble compiling lsof with gcc, try the UNIX dialect vendor's compiler. I don't have access to gcc on all test systems, so my support for it is hit-and-miss, and so is my ability to respond to gcc compilation problem reports.

- \* Check the lsof frequently asked questions file, 00FAQ, to see if there's a question and answer relevant to your problem.

- \* Make sure you're running the lsof you think you are by checking the path to it with `which(1)`. When in doubt, use an absolute path to lsof. Make sure that lsof binary has sufficient permissions to do what you ask, including internal permissions given it (e.g., restrictions on what files lsof may report for whom) during its build.

When you send a bug report, make sure you include output from your running of lsof's Configure script. If you were able to compile a running lsof, please also include:

- \* Output from `which(1)` that shows the absolute path to the lsof binary in question;

- \* Output from running lsof with its `-h` and `-v` options at

lsof's absolute path;

\* Output from "ls -l" directed to lsof's absolute path.

If you weren't able to compile a running lsof, please send me: the compiler error output; identification of the lsof revision you're using (contents of the lsof version.c file); identification of your system (full uname output or output from whatever other tool identifies the system); and compiler identification (e.g., gcc -v output).

Either set of output will help me understand how lsof was configured and what UNIX dialect and lsof revision is involved.

Please send all bug reports, requests, etc. to me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### The 00FAQ File

=====

The lsof distribution contains an extensive frequently asked questions file on lsof features and problems. I recommend you consult it before sending me e-mail. Use your favorite editor or pager to search 00FAQ -- e.g., supplying as a search argument some fixed text from an lsof error message.

#### The lsof-l Mailing List

=====

Information about lsof, including notices about the availability of new revisions, may be found in mailings of the lsof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the lsof distribution.

#### Field Output Example Scripts

=====

Example AWK and Perl 4 or 5 scripts for post-processing lsof field output are located in the scripts sub-directory of the lsof distribution. The scripts sub-directory contains a 00README file with information about the scripts.

#### Field Output C Library

=====

The lsof test suite (See "Testing Lsof."), checks basic lsof operations using field output. The test suite has its own library of C functions for common test program operations, including processing of field output. The library or selections of its functions could be adapted for use by C programs that want to process lsof field output. See the library in the file LTlib.c in the tests/ sub-directory

## Testing Lsof

=====

Lsof has an automated test suite in the tests/ sub-directory that can be used to test some basic lsof features -- once lsof has been configured and made. Tests are arranged in three groups: basic tests that should run on all dialects; standard tests that should run on all dialects; and optional tests that may not run on all dialects or may need special resources to run. See 00TEST for more information.)

CAUTION!!! Before you attempt to use the test suite make sure that the lsof you want to test can access the necessary kernel resources -- e.g., /dev/mem, /dev/kmem, /proc, etc. Usually you want to test the lsof you just built, so this is an important check. (See 00TEST.)

To run the basic and standard tests, using the lsof in the parent directory of tests/, do this:

```
$ cd tests
$ make test
 or $ make std
 or $ make standard
```

The basic and standard tests may be run as silently as possible, using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make auto
```

This is the "automatic" test mode, designed for use by scripts that build lsof. The caller is expected to test the make exit code to determine if the tests succeeded. The caller should divert standard output and standard error to /dev/null to suppress make's error exit message.

The optional tests may be run, using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make opt
 or $ make optional
```

It's possible to execute individual tests, too. See the 00TEST file of this distribution for more information on the tests, what they do, and how to run and possibly customize each test.

It's possible to run the tests, using an lsof other than the one in the parent directory of /tests, too. See 00TEST for information about using the LT\_LSOF\_PATH environment variable to do that.

```
=====
Dialect Notes
=====
```

AFS  
===

Lsof  
recognizes AFS files on the following combinations of UNIX dialect and AFS versions:

- AIX 4.1.4 (AFS 3.4a)
- Linux 1.2.13 (AFS 3.3)
- NEXTSTEP 3.2 (AFS 3.3) (untested on recent lsof revisions)
- Solaris 2.6 (AFS 3.4a)
- Ultrix 4.2 RISC (AFS 3.2b) (no longer available)

Lsof has not been tested under other combinations -- e.g. HP-UX 10.10 and AFS 3.4a -- and probably won't even compile there. Often when a UNIX dialect version or AFS version changes, the new header files come into conflict, causing compiler objections.

AIX  
===

Specify the aix Configure abbreviation for AIX 4.1.[45], 4.2[.1], 4.3[.123], 5L, and 5.[123].

Specify aixgcc on AIX above 4.1 to use the gcc compiler. (Gcc can't be used to compile lsof on AIX 4.1 and below because of kernel structure



alignment differences between it and xlc.) Gcc results sometimes depend on the version of the gcc compiler that is used.

Compilation of lsof with gcc on AIX 4.3[.123], 5L, and 5.[123] has been sparsely tested with varying degrees of success: it has been reported to succeed on AIX 4.3.3 and 32 bit Power AIX 5.1; to fail on ia64 AIX 5.1 and 64 bit Power AIX 5.1; and to succeed on 32 and 64 bit Power AIX 5.2. Lsof compilation with gcc hasn't been tested on AIX 5.3.

At revision 4.61 and above lsof is configured and built to match the bit size of the kernel of Power architecture AIX 5.1 systems. Lsof binaries built for 32 and 64 bit kernels are not interchangeable. See 00FAQ for more information.

The Configure script uses /usr/bin/oslevel to determine the AIX version for AIX less than 5 and ``uname -rv" for AIX 5 and higher. If /usr/bin/oslevel isn't executable on AIX less than 5, the Configure script issues a warning message and uses ``uname -rv" to determine the AIX version.

When Configure must use ``uname -rv" on AIX less than 5 to determine the AIX version, the result will lack a correct third component -- e.g., the `4' of ``4.1.4". If your AIX less than 5 system lacks an executable oslevel,

I suggest you edit the Configure-produced Makefile and complete the \_AIXV definition in the CFGF string.

By default lsof avoids using the kernel's readx() function, causing it to be unable to report information on some text and library file references. The ``-X" option allows the lsof user to ask for the information readx() supplies.

Lsof avoids readx() to avoid the possibility of triggering a kernel problem, known as the Stale Segment ID kernel bug. Kevin Ruderman reported this bug to me. The bug shows up when the kernel's dir\_search() function hangs, hanging the application process that called it so completely that the application process can neither be killed nor stopped. The hang is the consequence of another process (perhaps lsof) making legitimate use of the kernel's readx() function to access the kernel memory that dir\_search() is examining. IBM has indicated they have no plans to fix the bug.

A fuller discussion of this bug may be found in the 00FAQ file of the lsof distribution.

There you will find a description of the Stale Segment ID bug, the APAR on it, and a discussion of the sequence of events that exposes it.

I added the ``-X" function so you can tell lsof to use readx(), but if you use ``-X", you should be alert to its possibly serious side effects. Although readx() is normally disabled, its state is controlled with the HASXOPT, HASXOPT\_ROOT, and HASXOPT\_VALUE definitions in dialects/aix/machine.h, and you can change its default state by changing those definitions. You can also change HASXOPT\_ROOT via the Customize script.

You can also compile lsof with readx() use permanently enabled or disabled -- see the comments about the definitions in the dialects/aix/machine.h header file. You may want to permanently disable lsof's use of readx() if you plan to make lsof publicly executable. You can also restrict -X to processes whose real UID is root by defining HASXOPT\_ROOT.

I have never seen lsof cause the Stale Segment ID bug to occur and haven't had a report that it has, but I believe there is a possibility it could.

AFS support for AIX was added with help help from Bob Cook and Jan Tax who provided test systems.

Henry Grebler and David J. Wilson helped with lsof for AIX 4.2.

Bill Pemberton provided an AIX 4.3 test system. Andrew Kephart and Tom Weaver provided AIX 4.3 technical assistance. Niklas Edmundsson did 4.3.1 testing. Doug Crabill provided an AIX 4.3.2 test system. Jeff W. Stewart provided an AIX 4.3.3 test system.

The SMT file type for AIX 4.1.[45], 4.2[.1], and 4.3[.12] is my fabrication. See the 00FAQ file more information on it.

Loc Le and Nasser Momtaheni of IBM provided test systems for AIX 5L and 5.1. Lsof for AIX 5L and 5.1 needs setuid-root permission to process the -X option on systems whose architecture type is ia64.

Dale Talcott of Purdue provided AIX 5.1 and 5.2 test systems. Dale and John Jackson of Purdue provided an AIX 5.3 test system.

Apple Darwin  
=====

The Apple Darwin port was provided by Allan Nathanson for version 1.2. Allan also arranged for access to a test system for maintenance

and regression testing. Dale Talcott provided a test system, too.

Allan supplied patches for updates to 1.4, 5.x, 6.x, 7.x and 8.x.

## BSDI BSD/OS

=====

As of lsof revision 4.77 support for BSDI BSD/OS has been discontinued. Lsof revision 4.76 with BSDI BSD/OS support may be found on [lsof.itap.purdue.edu](http://lsof.itap.purdue.edu) in `pub/tools/unix/lsof/src`.

## DEC OSF/1, Digital UNIX, Tru64 UNIX

=====

Robert Benites, Dean Brock, Angel Li, Dwight McKay, Berkley Shands, Ron Young and Steve Wilson have kindly provided test systems. Jeffrey Mogul has provided technical assistance. Dave Morrison and Lawrence MacIntyre did Digital UNIX V3.2 testing.

Lsof supports the ADVFS/MSFS layered file system product. Lsof can locate all the open files of an ADVFS/MSFS file system when its path is specified, provided the file system is listed in `/etc/fstab` with an `advfs` type. (This `/etc/fstab` caveat applies only to Digital UNIX 2.0.) At Digital UNIX 4.0 and Tru64 UNIX, using code provided by David Brock, lsof 4.20 and above can locate ADVFS file paths.

Testing of lsof on DEC OSF/1 and Digital UNIX 4.0 ended with lsof revision 4.74. Hence, the lsof documentation has dropped the claim that it works there. For a distribution of lsof 4.74 that was tested on DEC OSF/1 and Digital UNIX 4.0, check `pub/tools/unix/lsof/OLD/src` on the lsof ftp home, [lsof.itap.purdue.edu](http://lsof.itap.purdue.edu).

Lsof revisions past 4.74 have only been tested on Tru64 UNIX 5.1.

## FreeBSD

=====

Bill Bormann of Purdue University provided access to several FreeBSD test systems. Ade Barkah, John Clear, Ralph Forsythe, Michael Haro, Kurt Jaeger, and William McVey have also provided FreeBSD test systems.

The FreeBSD distribution header files are augmented by header files

in the dialects/freebsd/include directory.

David O'Brien maintains the lsof FreeBSD port package.

## HP-UX

=====

Lsof has

two HP-UX bases: /dev/kmem for HP-UX 11.0 and earlier;  
and PSTAT for HP-UX 11.11 and later. The lsof Configure script  
will pick the appropriate base.

To use the CCITT x.25 socket support for HP-UX, you must have the  
x.25 header files in /etc/conf/x25

Pasi Kaara helped with the HP-UX port, especially with its CCITT  
x.25 socket support.

Richard Allen provided HP-UX 10.x and 11.x test systems, as did  
Mark Bixby, and Elias Halldor Agustsson. Marc Winkler helped test  
the 10.20 port. Richard J. Rauenzahn provided a 64 bit HP-UX 11  
test system and an HP-UX 11.11 development system.

AFS support for HP-UX was added thanks to help from Chaskiel Moses  
Grundman, who provided a test system.

The /dev/kmem-based HP-UX 11.00 support is extremely fragile. It  
depends on privately developed kernel structure definitions. (See  
.../dialects/hpux/hpux11 for the header files making the definitions.)  
Those header files and their definitions will not be updated by  
HP-UX 11.00 patches, making it likely  
that any patch changing a  
kernel structure critical to lsof will break lsof in some way.

It's possible to build a 64 bit lsof for 64 bit HP-UX 11.00 with  
gcc, but you must have a gcc compiler capable of producing 64 bit  
executables. See the 00FAQ file for more information.

The PSTAT-based lsof for HP-UX 11.11 and later is much more solid.  
I am indebted to the vision of HP for providing an lsof kernel API  
through the PSTAT implementation. Specifically I appreciate the  
help of HP staff members Carl Davidson, Louis Huemiller, Rich  
Rauenzahn, and Sailu Yallapragada that made PSTAT-based HP-UX lsof  
possible.

IPv6

====

Lsof has IPv6 support that has been tested for these UNIX dialects: AIX 4.3.x; Apple Darwin 5.[12] and 6.0; the INRIA and KAME FreeBSD IPv6 implementations; PSTAT-based HP-UX; /proc-based Linux; the INRIA and KAME NetBSD implementations; and Solaris 8 and 9. Lsof has IPv6 support that hasn't been tested for: OpenBSD (KAME); OpenUNIX 8; Tru64 Unix 5.[01]; and UnixWare 7.1.[34].

Please let me know if your UNIX dialect has IPv6 support and I'll see if it can be supported by lsof.

## Linux

=====

Tim Korb, Steve Logue, Joseph J. Nuspl Jr., and Jonathan Sergent have provided Linux test systems.

Michael Shields helped add and test automatic handling of ELF/COFF form names in /System.map, Marty Leisner and Keith Parks have helped test many lsof revisions. Marty has provided valuable suggestions, Linux hints, and code, too.

The 00FAQ file gives some Linux tips, including information on coping with system map file problems.

To determine the state of the Linux 2.1.x C library lseek() function, the lsof Configure script runs a test program that must have permission to read /dev/kmem. The test determines if the lseek() function properly handles kernel offsets, which appear to be negative because their high order bit is set. If the lseek() test reveals a faulty lseek(), Configure activates the use of a private lseek() function for kernel offset positioning.

See the Linux problems section of the 00FAQ file of the lsof distribution for more information.

## NetBSD

=====

Greg Earle and Paul Kranenburg have assisted with the NetBSD ports. Paul has provided test systems. Ray Phillips provided a NetBSD Alpha test system. Andrew Brown also provided a test system.

The NetBSD dialect version of lsof is compiled using the dialect

sources it shares with OpenBSD in the n+obsd dialect sub-directory.

#### NEXTSTEP and OPENSTEP

=====

Virtual memory header files that allow lsof to display text references were derived from the contents of /usr/include/vm of NEXTSTEP 2.0. NeXT did not ship the virtual memory header files with other NEXTSTEP or OPENSTEP versions.

You may use the RC\_FLAGS environment variable to declare compiler options outside the Makefile. A common use of this variable is to define the architecture types to be included in a "fat" executable. See the comments in dialects/next/Makefile for an example.

#### OpenBSD

=====

David

Mazieres has provided OpenBSD test systems. The OpenBSD dialect version of lsof is compiled using the dialect sources it shares with NetBSD in the n+obsd dialect sub-directory.

Kenneth Stailey has provided OpenBSD testing and advice.

John Dzuber (Zube) reports, "lsof 4.33 compiles and runs on OpenBSD 2.3 for the pmax architecture (decstation 3100)."

I have not tested lsof on OpenBSD 3.8, but David Mazieres reports revision 4.76 worked on OpenBSD 3.8.

#### Pyramid DC/OSx and Reliant UNIX

=====

As of lsof revision 4.52 support for all Pyramid dialects has been discontinued. Lsof revision 4.51 with Pyramid support may be obtained upon request. Send the request to [abe@purdue.edu](mailto:abe@purdue.edu).

These two UNIX dialects are very similar and share dialect-specific source files from the pyramid sub-directory.

The Reliant Unix Pyramid C compiler issues warning messages that I haven't found a convenient way to suppress. You can ignore warning messages about casts

and conversions that lose bits. The message "warning: undefining \_\_STDC\_\_" is intentionally caused by the lsof MkKernOpts configuration script to suppress warning messages about cast and conversion problems in standard system header files, such as <stdio.h> and <string.h>.

Bruce Beare and Kevin Smith provided test systems.

#### Caldera OpenUNIX

=====

Larry Rosenman provided an OpenUNIX 8 test system. Matthew Thurmaier provided technical assistance, along with these people from Caldera: Jack Craig, Robert Lipe, and Bela Lubkin.

Robert Lipe supplied changes to lsof for OpenUNIX 8.0.1. Those changes were also incorporated in UnixWare 7.1.3 when it became the release name for OpenUNIX 8.0.1.

Support for lsof on OpenUNIX ended at lsof revision 4.74. The last lsof revision, 4.74, tested on OpenUNIX, may be found at the lsof "home" ftp site, lsof.itap.purdue.edu, in pub/tools/unix/lsof/OLD/src.

#### SCO OpenServer

=====

Dion Johnson, Bela Lubkin, and Nathan Peterson of SCO gave me copies of SCO OpenServer and the SCO OpenServer Development System 3.0 and provided technical advice for the lsof port.

Hugh Dickins, Bela Lubkin, Craig B. Olofson, and Nathan Peterson provided version 5.0 and gave technical advice for porting lsof to it. Bela provided the 5.0.4 changes. D. Chris Daniels provided a 5.0.4 test system, Lee Penn provided one for 5.0.5, and John Dubois for 5.0.6.

The <netdb.h> header file was accidentally omitted from some SCO OpenServer Development System releases. The Configure script will sense its absence and substitute an equivalent from the BSD distribution. The BSD <netdb.h> and the <sys/cdefs.h> header file it includes are located in the dialects/os/include sub-directory tree.

To compile lsof from its distribution sources you must have the TCP/IP and NSF headers in /usr/include. While those are optional

OpenServer packages, I have access to no system that doesn't have them, so I'm unable to build lsof for such a configuration.

However, it should be possible to modify the lsof Configure script and sources so lsof would compile and work without those optional packages.

If you have an OpenServer system configured without the TCP/IP and NFS packages, and want to tackle the job of building lsof for it, contact me via e-mail at <abe@purdue.edu>. I'll identify the Configure script, header file, and source file changes you will need to make. (Caution: this is not a simple task, or I would have already done it.)

The optional osrgcc and scogcc Configure abbreviations construct Makefiles for compiling lsof with gcc.

The UnixWare 7.1.4 sources are used for OpenServer Release 6.0.0. Hence there is a separate Configure abbreviation for it, "osr6". Richard of SCO provided a test system and technical assistance.

SCO|Caldera UnixWare

=====

D. Chris Daniels, John Hughes, Ken Laing, Andrew Merrill, Lee Penn, and Matthew Thurmaier provided test systems. Bela Lubkin provided technical assistance. Larry Rosenman provided 7.1.[34] test systems.

Solaris 2.x, 7, 8, 9 and 10

=====

SEE THE CAUTIONS SECTION OF THIS DOCUMENT.

The latest Solaris revision of lsof 4 might work under Solaris 2.[1-4] and 2.5.[1] and 7 but hasn't been tested there. I have no test systems for those Solaris versions.

Lsof will compile with gcc and the Sun C compiler under Solaris. If you want to use the Sun compiler, use the solariscc Configure abbreviation. If you use a gcc version less than 2.8 on Solaris, make sure the gcc-specific includes have been updated for your version of Solaris -- i.e., run the gcc fixincludes script.

Solaris 7, 8, 9 and 10 support for 64 bit kernels depends on a Sun WorkShop or Forte C compiler version that supports the "-xarch=v9"



flag -- usually 5.0 or greater. Gcc versions 2.95 and above \*may\* be configured and built for 64 bit support, but it takes some extra work, the resulting compiler may be fragile, and the gcc developers discourage it. I've built 64 bit capable gcc compilers for Solaris 7, 8 and 9 from gcc versions 2.95 through 3.0.1 and produced working lsof executables with them. More information on 64 bit gcc for Solaris may be found in the 00FAQ file.

Solaris 10 ZFS support is questionable, because Sun does not distribute the ZFS kernel structure definition header files. The lsof Configure script and source code use some risky work-arounds. ZFS file system support was made possible with help from Horst Scheuermann.

Dave Curry and Steve Kirsch provided resources for Solaris 2.x ports. Casper Dik and Gerry Singleton consulted and provided valuable assistance.

Henry Katz, Joseph Kowalski, Charles Stephens, Mike Sullivan, and Mike Tracy provided technical assistance.

AFS support was added to Solaris lsof with help from Curt Freeland, Heidi Hornstein, Michael L. Lewis, Terry McCoy, Phillip Moore, and Sushila R. Subramanian.

Casper Dik provided valuable assistance for the Solaris 8 support.

Sun has graciously provided me access to BETA versions of Solaris 2.5, 2.6, 7, 8, and 9.

John Dzuberá provided Solaris 7 and 8 test systems.

Mike Miscevic provided Solaris 10 test systems.

Ultrix  
=====

As of lsof revision 4.52 support for Ultrix is no longer available, because I no longer have an Ultrix test system.

Terry Friedrichsen, Dwight McKay, and Jeffrey Mogul helped me with this port.

DECnet support was added to Ultrix lsof with the help of John Beacom, who kindly provided a test system. The Configure script decides that DECnet support is available if /usr/lib/libdnet.a and

/usr/include/netdnet/dn.h exist and are readable.

## Veritas VxFS and VxVM

=====

Lsof supports some versions of Veritas VxFS and VxVM on some UNIX dialects. Consult the lsof Configure script for the specific dialect, and consult the lsof dialect-specific source files for the UNIX dialect of interest. Veritas support will usually be found in a source file named dnode[1-9].c.

Since Veritas rarely has a version number that can be extracted with shell commands, lsof doesn't use it. Instead, when lsof supports Veritas, the Configure script will form compile-time definitions starting with HASVXFS. Check the lsof 00PORTING documentation file for more information.

Lsof Veritas support requires that the supporting Veritas header files be installed -- e.g., in /usr/include/sys/fs. (The location will depend in the dialect's header file conventions.)

Some information on lsof support for Veritas extensions may be found in the lsof 00DIST file.

Chris Kordish and Andy Thomas have provided Solaris VxFS test systems.

=====

## User-contributed Dialect Support

=====

There are some user-contributed dialect versions of lsof; more information on them can be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/contrib>

Check the 00INDEX file there for details.

=====

## Dialects No Longer Supported

=====

Because

I don't have access to test systems, these UNIX dialects are no longer supported by lsof:

CDC EP/IX  
/dev/kmem-based Linux  
MIPS RISC/os  
Motorola V/88  
Pyramid DC/OSx  
Pyramid Reliant UNIX  
Sequent DYNIX  
SGI IRIX  
SunOS 4.x  
Ultrix  
UnixWare below 7.0

Remnants of the support lsof once provided for these dialects may be found in:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/binaries>  
and  
<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/dialects>

=====  
Installing Lsof  
=====

The distributed Makefiles do not have actions that will install lsof. I've come to the conclusion there is no standard for installing lsof or its man page, so I no longer distribute make rules for installing them. You should adjust the Makefile for your local preferences.

The Makefile does have an install rule that will cause lsof to compile by virtue of its dependency clause. Some Makefiles also have a dependency that causes the production of a man page that is ready to install.

However, the actions of the install rule will not cause the lsof executable or its man page to be installed in any UNIX system-wide directory.

Instead, after the compilation and optional man page production are completed, the install rule will produce a brief description of what actions you might add to the install rule. The description will suggest the possible modes, ownerships, permissions, and destinations your install rule might employ to install the lsof executable and man page.

As you form your install rule, keep in mind that lsof usually needs some type of special permission to do its job. That may be permission to read memory devices such as /dev/kmem, /dev/mem, or /dev/swap, or it may be authorization to read entries in the /proc file system.

Memory device access can usually be provided by setting the modes of the lsof executable so that its effective group identifier when it runs is the same as the group that has permission to read the memory devices -- i.e., it is setgid-group. The privileged group is usually kmem, sys, or system.

Don't overlook using ACLs -- e.g., on AIX or Solaris 8 -- to give lsof permission to access memory devices. ACLs, coupled to a separate group like kmem, can be safer than giving lsof setgid authorization to a commonly used system group.

When lsof needs to read /proc file system entries, it must be installed with modes that make its effective user identifier root when it runs -- i.e., it must be setuid-root. If lsof must be installed setuid-root (only the AIX 5L, PSTAT-based HP-UX, and /proc-based Linux, ports need such power.), then access to memory devices is automatic (or not needed in the case of /proc-based Linux).

Your choice of permissions for lsof may also be affected by your desire to allow anyone to use it or your need to restrict its usage to specific individuals. You will have to be guided by local policy and convention in this case.

The next two sections, Setgid Lsof Dialect Versions and Setuid-root Lsof

Dialect Versions, list recommended install permissions.

The system directory where you install the lsof executable is also open to choice. A traditional place for a tool like lsof is /usr/local/etc, but recent changes in directory structure organization suggest that somewhere in /opt may be more suitable.

Bear one other factor in mind when choosing a location for the lsof executable -- it usually is a shared executable, requiring access to shared libraries. Thus, locations like /sbin or /usr/sbin are probably unsuitable.

Once you've chosen a location for the executable you may find that the location for the man page follows -- e.g., if the executable goes in /usr/local/etc, then the man page goes in /usr/local/man. If the executable location doesn't imply a location for the man

page, you'll have to let local custom guide you.

### Setuid-root Lsof Dialect Versions

=====

These dialect versions should be installed with setuid-root permission -- i.e., the lsof binary should be owned by root and its setuid execution bit (04000) should be set.

AIX 5L and above for full use of the -X option  
Apple Darwin 8.x for Power Macintosh systems  
PSTAT-based HP-UX 11.11 and 11.23  
/proc-based Linux (generally 2.1.72 and above)

### Setgid Lsof Dialect Versions

=====

These dialect versions should be installed with setgid permission, owned by the group that can read kernel memory devices such as /dev/drum, /dev/kmem, /dev/ksyms, /dev/mem, /dev/swap. ACLs may be another mechanism (e.g., under AIX or Solaris 8) you can use to grant read permission to the kernel memory devices.

AIX 4.1.[45], 4.2[.1], and 4.3[.123]  
Apple Darwin 7.x for Power Macintosh systems  
DEC OSF/1, Digital UNIX, Tru64 UNIX 2.0, 3.2, 4.0, and 5.[01]  
FreeBSD 2.1.6, 2.2[.x], 3.x, 4.x, 5.x and [67].x  
/dev/kmem-based 11.00  
NetBSD 1.[456], 2.x and 3.x  
NEXTSTEP 3.[13]  
OpenBSD 2.[89] and 3.[0-9]  
OPENSTEP 4.x  
Caldera OpenUNIX 8  
SCO OpenServer 5.0.[46]  
SCO  
UnixWare 7.0 and 7.1.[0134]  
Solaris 2.6, 8, 9 and 10  
Ultrix 4.2 (no longer available)

=====

### Porting Lsof 4 to a New UNIX Dialect

=====

If you're brave enough to consider this, look at the 00PORTING file. Please contact me before you start. I might be able to help

you or even do the port myself.

Don't overlook the contrib/ directory in pub/tools/unix/lsof on my ftp server, lsof.itap.purdue.edu. It contains user-contributed ports of lsof to dialects I don't distribute, because I can't test new revisions of lsof on them.

=====  
Quick Start to Using lsof  
=====

For information on how to get started quickly using lsof, consult the 00QUICKSTART file of the lsof distribution. It cuts past the formal density of the lsof man page to provide quick examples of using lsof to solve common open file display problems.

=====  
Cross-configuring lsof  
=====

Using

environment variables it is possible to Configure (and possibly build) lsof for one UNIX dialect on a different one -- e.g., you are running Configure on a Linux 2.3 system and you want to Configure and build lsof for Linux 2.4.

See the 00XCONFIG file of the lsof distribution for a discussion of how to do this.

=====  
Environment Variables Affecting the Configure Script  
=====

Configure script actions can be modified by introducing values to the script via environment variables. In many cases the environment variable values take the place of test operations the Configure script makes.

For more information on environment variables that can affect Configure, consult the 00XCONFIG file of the lsof distribution. See the General Environment Variables sections for descriptions of ones that affect all dialects. Consult the Dialect-Specific Environment Variables section for ones that might affect the dialect you are trying to configure.

Vic Abell <abe@purdue.edu>

April 24, 2007

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\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/00README

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\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/util.c  
\* /opt/cola/permits/1550988360\_1675319900.3624527/0/Isf-4-85-zip/dialects/freebsd/dnode2.c  
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# 1.326 syslinux 6.03

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```

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(at your option) any later version.
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```
Gnomovision version 69, Copyright (C) 19yy name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

The hypothetical commands

```
`show w' and `show c' should show the appropriate
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mouse-clicks or menu items--whatever suits your program.
```

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```
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`Gnomovision' (which makes passes at compilers) written by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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```
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```
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## 1.329 gvfs 1.28.2

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Also, for each distributor's protection, we want to make certain that everyone understands that there is no warranty for this free library. If the library is modified by someone else and passed on, we want its recipients to know that what they have is not the original version, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that companies distributing free software will individually obtain patent licenses, thus in effect transforming the program into proprietary software. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary one; be sure to read it in full, and don't assume that anything in it is the same as in the ordinary license.

The reason we have a separate public license for some libraries is that

they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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0. This License Agreement applies to any software library which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Library General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has

been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for

that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for



reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

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```
<one line to give the library's name and a brief idea of what it does.>
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<year> <name of author>
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Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library `Frob' (a library for tweaking knobs) written by James Random Hacker.

```
<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice
```

That's all there is to it!

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Version 3, 29 June 2007

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For example, if you distribute copies of such a program, whether gratis or for a fee, you must pass on to the recipients the same freedoms that you received. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

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For the developers' and authors' protection, the GPL clearly explains

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Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

## TERMS AND CONDITIONS

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"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

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#### 1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

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The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to

control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

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#### 6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

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b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.

c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

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@vskip 20pt plus 1fil
@end macro
```

```
@macro copyrightstart{ }
@end macro
```

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@macro copyrightend{ }
@end macro
```

```
@node Copyrights and Licenses, , Acknowledgments, Top
@comment node-name, next, previous, up
@appendix Copyrights and Licenses
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AES in libhcrypto

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rijndael-alg-fst.c

@version 3.0 (December 2000)

Optimised ANSI C code for the Rijndael cipher (now AES)

@author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>

@author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>

@author Paulo Barreto <paulo.barreto@terra.com.br>

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# 1.333 aiofiles 23.1.0

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## 1.334 util-linux 2.22.2

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cmd/krb5/kadmin/server/iproplib_svc.c
cmd/krb5/kproplog/kproplog.c
cmd/krb5/slave/kpropd_rpc.c
lib/gss_mechs/mech_krb5/et/kdb5_err.c
lib/gss_mechs/mech_spnego/mech_gssapiP_spnego.h
lib/gss_mechs/mech_spnego/mech_spnego_mech.c
lib/krb5/kadm5/kadm_host_srv_names.c
lib/krb5/kdb/kdb_convert.c
```

lib/krb5/kdb/kdb\_hdr.h  
lib/krb5/kdb/kdb\_log.c  
lib/krb5/kdb/kdb\_log.h  
lib/libgss/g\_accept\_sec\_context.c  
lib/libgss/g\_acquire\_cred.c  
lib/libgss/g\_canon\_name.c  
lib/libgss/g\_compare\_name.c  
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lib/libgss/g\_delete\_sec\_context.c  
lib/libgss/g\_dsp\_name.c  
lib/libgss/g\_dsp\_status.c  
lib/libgss/g\_dup\_name.c  
lib/libgss/g\_exp\_sec\_context.c  
lib/libgss/g\_export\_name.c  
lib/libgss/g\_glue.c  
lib/libgss/g\_imp\_name.c  
lib/libgss/g\_imp\_sec\_context.c  
lib/libgss/g\_init\_sec\_context.c  
lib/libgss/g\_initialize.c  
lib/libgss/g\_inquire\_context.c  
lib/libgss/g\_inquire\_cred.c  
lib/libgss/g\_inquire\_names.c  
lib/libgss/g\_process\_context.c  
lib/libgss/g\_rel\_buffer.c  
lib/libgss/g\_rel\_cred.c  
lib/libgss/g\_rel\_name.c  
lib/libgss/g\_rel\_oid\_set.c  
lib/libgss/g\_seal.c  
lib/libgss/g\_sign.c  
lib/libgss/g\_store\_cred.c  
lib/libgss/g\_unseal.c  
lib/libgss/g\_userok.c  
lib/libgss/g\_utils.c  
lib/libgss/g\_verify.c  
lib/libgss/gssd\_pname\_to\_uid.c  
uts/common/gssapi/include/gssapi\_err\_generic.h  
uts/common/gssapi/include/mechglueP.h

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The implementations of GSSAPI mechglue in GSSAPI-SPNEGO in "src/lib/gssapi", including the following files:

- lib/gssapi/generic/gssapi\_err\_generic.et
- lib/gssapi/mechglue/g\_accept\_sec\_context.c
- lib/gssapi/mechglue/g\_acquire\_cred.c
- lib/gssapi/mechglue/g\_canon\_name.c
- lib/gssapi/mechglue/g\_compare\_name.c
- lib/gssapi/mechglue/g\_context\_time.c
- lib/gssapi/mechglue/g\_delete\_sec\_context.c
- lib/gssapi/mechglue/g\_dsp\_name.c
- lib/gssapi/mechglue/g\_dsp\_status.c
- lib/gssapi/mechglue/g\_dup\_name.c
- lib/gssapi/mechglue/g\_exp\_sec\_context.c
- lib/gssapi/mechglue/g\_export\_name.c
- lib/gssapi/mechglue/g\_glue.c
- lib/gssapi/mechglue/g\_imp\_name.c
- lib/gssapi/mechglue/g\_imp\_sec\_context.c
- lib/gssapi/mechglue/g\_init\_sec\_context.c
- lib/gssapi/mechglue/g\_initialize.c
- lib/gssapi/mechglue/g\_inquire\_context.c
- lib/gssapi/mechglue/g\_inquire\_cred.c
- lib/gssapi/mechglue/g\_inquire\_names.c
- lib/gssapi/mechglue/g\_process\_context.c
- lib/gssapi/mechglue/g\_rel\_buffer.c
- lib/gssapi/mechglue/g\_rel\_cred.c
- lib/gssapi/mechglue/g\_rel\_name.c
- lib/gssapi/mechglue/g\_rel\_oid\_set.c
- lib/gssapi/mechglue/g\_seal.c
- lib/gssapi/mechglue/g\_sign.c
- lib/gssapi/mechglue/g\_store\_cred.c
- lib/gssapi/mechglue/g\_unseal.c
- lib/gssapi/mechglue/g\_userok.c
- lib/gssapi/mechglue/g\_utils.c
- lib/gssapi/mechglue/g\_verify.c
- lib/gssapi/mechglue/gssd\_pname\_to\_uid.c
- lib/gssapi/mechglue/mglueP.h
- lib/gssapi/mechglue/oid\_ops.c
- lib/gssapi/spnego/gssapiP\_spnego.h
- lib/gssapi/spnego/spnego\_mech.c

and the initial implementation of incremental propagation, including the following new or changed files:

- include/iprop\_hdr.h
- kadmin/server/ipropd\_svc.c
- lib/kdb/iprop.x

lib/kdb/kdb\_convert.c  
lib/kdb/kdb\_log.c  
lib/kdb/kdb\_log.h  
lib/krb5/error\_tables/kdb5\_err.et  
kprop/kpropd\_rpc.c  
kprop/kproplog.c

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This file contains a list of people who have made large contributions to the public version of Protocol Buffers.

Original Protocol Buffers design and implementation:

Sanjay Ghemawat <sanjay@google.com>

Jeff Dean <jeff@google.com>

Daniel Dulitz <daniel@google.com>

Craig Silverstein

Paul Haahr <haahr@google.com>

Corey Anderson <corin@google.com>

(and many others)

Proto2 C++ and Java primary author:

Kenton Varda <kenton@google.com>

Proto2 Python primary authors:

Will Robinson <robinson@google.com>

Petar Petrov <petar@google.com>

Java Nano primary authors:

Brian Duff <bduff@google.com>

Tom Chao <chaot@google.com>

Max Cai <maxtroy@google.com>

Ulas Kirazci <ulas@google.com>

Large code contributions:

Jason Hsueh <jasonh@google.com>

Joseph Schorr <jschorr@google.com>

Wenbo Zhu <wenboz@google.com>

Large quantity of code reviews:

Scott Bruce <sbruce@google.com>  
Frank Yellin  
Neal Norwitz <nnorwitz@google.com>  
Jeffrey Yasskin <jyasskin@google.com>  
Ambrose  
Feinstein <ambrose@google.com>

Documentation:

Lisa Carey <lcarey@google.com>

Maven packaging:

Gregory Kick <gak@google.com>

Patch contributors:

Kevin Ko <kevin.s.ko@gmail.com>  
\* Small patch to handle trailing slashes in --proto\_path flag.

Johan Euphrosine <proppy@aminche.com>  
\* Small patch to fix Python CallMethod().

Ulrich Kunitz <kune@deine-taler.de>  
\* Small optimizations to Python serialization.

Leandro Lucarella <llucax@gmail.com>  
\* VI syntax highlighting tweaks.  
\* Fix compiler to not make output executable.

Dilip Joseph <dilip.antony.joseph@gmail.com>  
\* Heuristic detection of sub-messages when printing unknown fields in text format.

Brian Atkinson <nairb774@gmail.com>  
\* Added @Override annotation to generated Java code where appropriate.

Vincent Choinire <Choiniere.Vincent@hydro.qc.ca>  
\* Tru64 support.

Monty Taylor <monty.taylor@gmail.com>  
\* Solaris 10 + Sun Studio fixes.

Alek Storm <alek.storm@gmail.com>  
  
\* Slicing support for repeated scalar fields for the Python API.

Oleg Smolsky <oleg.smolsky@gmail.com>  
\* MS Visual Studio error format option.  
\* Detect unordered\_map in stl\_hash.m4.

Brian Olson <brianolson@google.com>  
\* gzip/zlib I/O support.

Michael Poole <mdpoole@troilus.org>  
\* Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).  
\* Added generation of field number constants.

Wink Saville <wink@google.com>  
\* Fixed initialization ordering problem in logging code.

Will Pierce <willp@nuclei.com>

\* Small patch improving performance of in Python serialization.  
Alexandre Vassalotti <alexandre@peadrop.com>  
\* Emacs mode for Protocol Buffers (editors/protobuf-mode.el).  
Scott Stafford <scott.stafford@gmail.com>  
\* Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.  
Alexander Melnikov <alm@sibmail.ru>  
\* HPUX support.  
Oliver Jowett <oliver.jowett@gmail.com>  
\* Detect whether zlib is new enough in configure script.  
\* Fixes for Solaris 10 32/64-bit confusion.  
Evan Jones <evanj@mit.edu>  
\* Optimize Java serialization code when writing a small message to a stream.  
\* Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.  
\* Clean up some Java warnings.  
\* Fix bug with permanent callbacks that delete themselves when run.  
Michael Kucharski <m.kucharski@gmail.com>  
\* Added CodedInputStream.getTotalBytesRead().  
Kacper Kowalik <xarthisius.kk@gmail.com>  
\* Fixed m4/acx\_pthread.m4 problem for some Linux distributions.  
William Orr <will@worrbase.com>  
\* Fixed detection of sched\_yield on Solaris.  
\* Added atomicops for Solaris  
Andrew Paprocki <andrew@ishiboo.com>  
\* Fixed minor IBM xLC compiler build issues  
\* Added atomicops for AIX (POWER)  
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## 1.342 swagger-integration 2.1.9

### 1.342.1 Available under license :

Apache-2.0

## 1.343 springdoc-openapi-common 1.5.9

### 1.343.1 Available under license :

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```
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```

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```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/customizers/ActuatorOperationCustomizer.java
*
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/SpringdocBeanFactoryConfigurer.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
```

jar/org/springdoc/core/SpringdocActuatorBeanFactoryConfigurer.java

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 *
 */
```

Found in path(s):

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/linkparameter/Builder.java
```

```
*
```

```
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/link/Builder.java
```

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/servervariable/Builder.java
```

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/server/Builder.java
```

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/extensionproperty/Builder.java
```

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/securityrequirement/Builder.java
```

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/arraychema/Builder.java
```

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/AbstractSpringdocRouteBuilder.java
```

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```
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/header/Builder.java
```

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
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jar/org/springdoc/core/fn/builders/parameter/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/externaldocumentation/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/encoding/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/discriminatoremapping/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/content/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/apiresponse/Builder.java
*
/opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/schema/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/exampleobject/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/requestbody/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/extension/Builder.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/builders/operation/Builder.java
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 */
```

Found in path(s):

```
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
jar/org/springdoc/core/fn/RouterFunctionData.java
* /opt/cola/permits/1612572912_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-
```

jar/org/springdoc/core/converters/models/DefaultPageable.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/SecurityService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/Constants.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/api/annotations/ParameterObject.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/customizers/ParameterCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/ParameterInfo.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/customizers/OperationCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/SwaggerUiConfigProperties.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/CacheOrGroupedOpenApiCondition.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/converters/FileSupportConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/converters/models/Pageable.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/MultipleOpenApiSupportCondition.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/GenericResponseService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/ui/SpringDocUIException.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/annotations/RouterOperations.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/SpringDocUtils.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/api/AbstractOpenApiResource.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/converters/models/MonetaryAmount.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/GenericParameterService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/converters/ResponseSupportConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/converters/models/PageableAsQueryParam.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-  
jar/org/springdoc/core/customizers/OpenApiCustomiser.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-

jar/org/springdoc/core/converters/AdditionalModelsConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/GroupedOpenApi.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/fn/RouterOperation.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/ReturnTypeParser.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SecuritySchemePair.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/OpenAPIService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SwaggerUiOAuthProperties.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/annotations/RouterOperation.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/AbstractRequestService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SecurityOAuth2Provider.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/AbstractSwaggerUiConfigProperties.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/PropertyCustomizingConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/OperationService.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/ModelConverterRegistrar.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/MethodAttributes.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/PropertyResolverUtils.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SpringDocPropertiesUtils.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/fn/AbstractRouterFunctionVisitor.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/ActuatorProvider.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/RequestBodyInfo.java  
\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/ControllerAdviceInfo.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/api/mixins/SortedSchemaMixin.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/MethodParameterPojoExtractor.java

\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/RequestTypeToIgnoreConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/SchemaPropertyDeprecatingConverter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/api/mixins/SortedOpenAPIMixin.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SpringDocAnnotationsUtils.java

\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SpringDocConfigProperties.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SpringDocConfiguration.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/RequestBodyService.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/customizers/OpenApiBuilderCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/MultipleOpenApiGroupsCondition.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/DelegatingMethodParameter.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/ui/AbstractSwaggerIndexTransformer.java

\*  
/opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/ui/AbstractSwaggerWelcome.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/SwaggerUiConfigParameters.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/ConverterUtils.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/customizers/PropertyCustomizer.java  
\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/core/converters/PolymorphicModelConverter.java

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\* /opt/cola/permits/1612572912\_1681847243.7944667/0/springdoc-openapi-common-1-5-9-sources-jar/org/springdoc/api/ErrorMessage.java

## 1.344 swagger-models 2.1.9

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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/XML.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/parameters/Parameter.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/ArraySchema.java  
\*  
/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/DateSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/examples/Example.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/security/OAuthFlows.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/Content.java

\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/BinarySchema.java  
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/IntegerSchema.java  
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/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/parameters/HeaderParameter.java  
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\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/Components.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/Operation.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/EmailSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/Schema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/ByteArraySchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/MapSchema.java  
\*  
/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/security/SecurityRequirement.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/ObjectSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/security/SecurityScheme.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/DateTimeSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/servers/ServerVariable.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/NumberSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/info/Contact.java  
\*  
/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/servers/ServerVariables.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/PathItem.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/media/FileSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/parameters/QueryParameter.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-



jar/io/swagger/v3/oas/models/media/MediaType.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/parameters/CookieParameter.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/media/BooleanSchema.java  
\*  
/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/responses/ApiResponse.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/security/OAuthFlow.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/callbacks/Callback.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/info/License.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/tags/Tag.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/links/LinkParameter.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/servers/Server.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/ExternalDocumentation.java  
\*  
/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/security/Scopes.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/responses/ApiResponse.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/media/ComposedSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/media/PasswordSchema.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/headers/Header.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/parameters/PathParameter.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/media/UUIDSchema.java  
\*  
/opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/links/Link.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/Paths.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/OpenAPI.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/media/Encoding.java  
\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-  
jar/io/swagger/v3/oas/models/media/StringSchema.java

\* /opt/cola/permits/1612572941\_1681848040.6274445/0/swagger-models-2-1-9-sources-1-jar/io/swagger/v3/oas/models/parameters/RequestBody.java

# 1.345 springdoc-openapi-webmvc-core 1.5.9

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Found in path(s):

\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/core/fn/SpringdocRouteBuilder.java

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\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/api/MultipleOpenApiWebMvcResource.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/api/OpenApiWebMvcResource.java  
\*  
/opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/core/RequestService.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/api/MultipleOpenApiActuatorResource.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/api/OpenApiActuatorResource.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/core/MultipleOpenApiSupportConfiguration.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/core/ActuatorWebMvcProvider.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/core/RouterFunctionProvider.java  
\*  
/opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/core/SpringDocWebMvcConfiguration.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/api/MultipleOpenApiResource.java  
\* /opt/cola/permits/1612572860\_1679608931.4898906/0/springdoc-openapi-webmvc-core-1-5-9-sources-jar/org/springdoc/webmvc/api/OpenApiResource.java

# 1.346 boost 1.80.0

## 1.346.1 Available under license :

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Julian Seward, jseward@acm.org  
bzip2/libbzip2 version 1.0.8 of 13 July 2019

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////

```
[#mpl]
MPL Support, <boost/mp11/mpl.hpp>
:toc:
:toc-title:
:idprefix:
```

The header ``<boost/mp11/mpl.hpp>``, when included, defines the necessary support infrastructure for ``mp_list`` and ``std::tuple`` to be valid link:`../..../libs/mpl[MPL]` sequences.

NOTE: ``mpl.hpp`` is not included by ``<boost/mp11.hpp>``.

It's also possible to only enable support for ``mp_list`` by including ``<boost/mp11/mpl_list.hpp>``, and for ``std::tuple`` by including ``<boost/mp11/mpl_tuple.hpp>``. This may be required because some libraries, such as Boost.Fusion, contain their own MPL

support for `std::tuple`, which conflicts with Mp11's one.

.Converting an existing MPL Sequence into an mp\_list

...

using L = mpl::copy<Sequence, mpl::back\_inserter<mp11::mp\_list<>>>::type;

...

The following people hereby grant permission to replace all existing licenses on their contributions to Boost with the Boost Software License, Version 1.0. (boostinspect:nolicense boostinspect:nocopyright)

Aleksey Gurtovoy (agurtovoy@meta-comm.com)

Andrei Alexandrescu (andrewalex - at - hotmail.com) (See Boost list message of August 12, 2004 11:06:58 AM EST)

Andrew Lumsdaine ()

Anthony Williams (anthony -at- justsoftwaresolutions.co.uk)

Beman Dawes (bdawes@acm.org)

Brad King (brad.king -at- kitware.com) (See Boost list message of Wed, 21 Jul 2004 11:15:46 -0400)

Brian Osman (osman -at- vvisions.com) (See CVS log)

Bruce Barr (schmoost -at- yahoo.com) (See Boost list of Mon, 16 Aug 2004 15:06:43 -0500)

Bruno da Silva de Oliveira (bruno - at - esss.com.br)

Christain Engstrom (christian.engstrom -at- glindra.org) (See Boost list message of Mon, 30 Aug 2004 14:31:49 +0200)

Cromwell D Enage (sponage -at- yahoo.com) (See Boost list message of August 12, 2004 11:49:13 AM EST)

Dan Gohman (djg

-at- cray.com) (See Boost list message of Sat, 21 Aug 2004 10:54:59 +0100)

Dan Nuffer (dan -at- nuffer.name)

Daniel Frey (d.frey -at- gmx.de, daniel.frey -at- aixigo.de)

Daniel Nuffer (dan -at- nuffer.name)

Darin Adler (darin -at- bentspoon.com) (Email to Andreas Huber, see change log)

Daryle Walker (darylew - at - hotmail.com)

Dave Abrahams (dave@boost-consulting.com)

Dave Moore (dmoore -at- viefinancial.com) (See Boost list message of 18 Dec 2003 15:35:50 -0500)

David Abrahams (dave@boost-consulting.com)

Dietmar Kuehl (dietmar\_kuehl -at- yahoo.com) (Email to Andreas Huber, see change log)

Douglas Gregor (gregod -at- cs.rpi.edu, dgregor -at- cs.indiana.edu, doug.gregor -at- gmail.com)

Dr John Maddock (john - at - johnmaddock.co.uk)

Edward D. Brey (brey -at- ductape.net) (Email to Andreas Huber, see change log)

Eric Ford (un5o6n902 -at- sneakemail.com) (See Boost list message of Sun, 15 Aug 2004 10:29:13 +0100)

Eric Friedman (ebf@users.sourceforge.net)

Eric Niebler (eric@boost-consulting.com)

Fernando

Cacciola (fernando\_cacciola@ciudad.com.ar)

Fernando Luis Cacciola Carballal (fernando\_cacciola@ciudad.com.ar)

Francois Faure (Francois.Faure -at- imag.fr) (See CVS log)

Gary Powell (powellg - at - amazon.com) (See Boost list message of 10 Feb 2004 14:22:46 -0800)

Gennadiy Rozental (rogeeff -at- mail.com) (Email to Andreas Huber, see change log)

Gottfried Ganssauge (Gottfried.Ganssauge -at- HAUF.DE) (See Boost List message of Mon, 16 Aug 2004 10:09:19 +0200)

Gottfried Ganauge (Gottfried.Ganssaue -at- HAUFE.DE) (Alternative spelling of Gottfried Ganssaue)  
Greg Colvin (gregory.colvin -at- oracle.com) (See Boost list message of Sat, 14 Aug 2004 10:57:00 +0100)  
Gregory Colvin (gregory.colvin -at- oracle.com) (See Boost list message of Sat, 14 Aug 2004 10:57:00 +0100)  
Gunter Winkler (gunter.winkler -at- unibw-muenchen.de) (See Boost List message of Mon, 16 Aug 2004 10:24:17 +0200)  
Hartmut Kaiser (hartmut.kaiser -at- gmail.com)  
Herve Bronnimann (hbr -at- poly.edu)  
Herv  
Brnnimann (hbr -at- poly.edu)  
Housemarque Oy (Ilari Kuittinen ilari.kuittinen -at- housemarque.fi)  
Howard Hinnant (hinnant -at- twcnny.rr.com) (See Boost list message of July 25, 2004 3:44:49 PM EST)  
Hubert Holin (hubert\_holin -at- users.sourceforge.net)  
Indiana University ()  
Itay Maman (imaman -at- users.sourceforge.net)  
Jaakko Jrv (jajarvi -at- osl.iu.edu)  
Jaap Suter (j.suter -at- student.utwente.nl) (See Boost list message of Thu, 16 Sep 2004 09:32:43 -0700)  
Jeff Garland (jeff - at - crystalclearsoftware.com) (see Boost list post of July 25, 2004 19:31:09 -0700)  
Jens Maurer (Jens.Maurer@gmx.net)  
Jeremy G Siek (jsiek@osl.iu.edu)  
Jeremy Siek (jsiek@osl.iu.edu)  
Joel de Guzman (joel -at- boost-consulting.com) (See Boost list message of July 25, 2004 8:32:00 PM EST)  
John Bandela (jbandela-at-ufl.edu)  
John Maddock (john - at - johnmaddock.co.uk)  
John R Bandela (jbandela-at-ufl.edu)  
Jonathan Turkanis (turkanis -at- coderage dot com)  
Juergen Hunold (hunold -at- ive.uni-hannover.de) (See Boost  
List Message of Fri, 13 Aug 2004 19:39:55 +0200)  
Kevlin Henney (kevin -at- curbralan.com) (See Boost list message of Wed, 15 Sep 2004 18:15:17 +0200)  
Kresimir Fresl (fresl -at- master.grad.hr) (See Boost List message of August 16, 2004 8:23:35 AM EST)  
Lars Gullik Bjnnes (larsbj -at- lyx.org) (See Boost list message of Tue, 17 Aug 2004 15:49:02 +0100)  
Lie-Quan Lee (liequan - at - slac.stanford.edu, llee - at - cs.indiana.edu)  
Maarten Keijzer (mkeijzer -at- cs.vu.nl) (See Boost list message of Wed, 18 Aug 2004 21:43:18 +0100)  
Mac Murrett (mmurrett -at- mac.com)  
Marc Wintermantel (wintermantel -at- imes.mavt.ethz.ch, wintermantel -at- even-ag.ch) (See CVS log)  
Michael Glassford (glassfordm - at - hotmail.com)  
Michael Stevens (Michael.Stevens - at - epost.de)  
Multi Media Ltd. (pdimov@mmltd.net)  
Nicolai M Josuttis (solutions -at- josuttis.com) (See Boost list message of Mon, 30 Aug 2004 10:52:00 +0100)  
Nikolay Mladenov (nickm -at- sitius.com) (See Boost list message of Tue, 17 Aug 2004  
15:45:33 +0100)  
Paul Mensonides (pmenso57 -at- comcast.net) (See Boost list message of July 21, 2004 1:12:21 AM EST)  
Pavol Droba (droba -at- topmail.sk)  
Peter Dimov (pdimov@mmltd.net)  
R W Grosse-Kunstleve (RWGrosse-Kunstleve@lbl.gov)  
Ralf W. Grosse-Kunstleve (RWGrosse-Kunstleve@lbl.gov)  
Rational Discovery LLC (Greg Landrum Landrum -at- RationalDiscovery.com) (See Boost list post of Tue, 17 Aug  
2004 10:35:36 +0100)  
Rene Rivera (grafik/redshift-software.com, rrivera/acm.org)

Robert Ramey (ramey@www.rrsd.com)  
Roland Richter (roland -at- fill.jku.at) (See Boost list post of Mon, 16 Aug 2004 22:16:55 +0200)  
Roland Schwarz (roland.schwarz -at- chello.at)  
Ronald Garcia (garcia -at- cs.indiana.edu) (Email to Andreas Huber, see change log)  
Samuel Krempp (krempp -at- crans.ens-cachan.fr) (See Boost list message of Mon, 27 Sep 2004 13:18:36 +0200)  
Stefan Seefeld (seefeld -at- sympatico.ca)  
Stephen Cleary (scleary -at- jerviswebb.com) (See Boost list message of Tue, 28 Sep 2004 13:11:46 +0100)  
Steve  
Cleary (Variant of Stephen Cleary)  
Sylvain Pion (Sylvain.Pion - at - sophia.inria.fr)  
The Trustees of Indiana University ()  
Thomas Witt (witt - at - ive.uni-hannover.de, witt - at - acm.org, witt - at - styleadvisor.com)  
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Thorsten Ottosen (nesotto - at - cs.auc.dk)  
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```
<!DOCTYPE html>
```

```
<html>
```

```
<head></head>
```

```
<body>
```

```
<h3>
```

```
 Copyright Test
```

```
</h3>
```

```
<p class="copyright">
```

```
 1963, 1964, 1965 Jane Doe
```

```
</p>
```

```
<p class="copyright">
```

```
 2018 Joe Blow, John Coe
```

```
</p>
```

```
<p class="copyright">
```

```
 1977, 1985 Someone else
```

```
</p>
```

```
</body>
```

```
</html>
```

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```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE article PUBLIC "-//Boost//DTD BoostBook XML V1.0//EN"
"http://www.boost.org/tools/boostbook/dtd/boostbook.dtd">
<article id="copyright_test" last-revision="DEBUG MODE Date: 2000/12/20 12:00:00 $"
xmlns:xi="http://www.w3.org/2001/XInclude">
 <title>Copyright Test</title>
 <articleinfo>
 <copyright>
 <year>1963</year> <year>1964</year> <year>1965</year> <holder>Jane Doe</holder>
 </copyright>
 <copyright>
 <year>2018</year> <holder>Joe Blow, John Coe</holder>
 </copyright>
 <copyright>
```

```
<year>1977</year> <year>1985</year> <holder>Someone else</holder>
</copyright>
</articleinfo>
</article>
```

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Found in path(s):

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/jetty/JettyStatisticsMetrics.java  
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\*/

Found in path(s):

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/composite/CompositeCustomMeter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/dropwizard/DropwizardDistributionSummary.java

```

*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/TimeWindowMax.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardConfig.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/TimeWindowPercentileHistogram.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/search/MeterNotFoundException.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardFunctionCounter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/AbstractCompositeMeter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/package-info.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jvm/DiskSpaceMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeLongTaskTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardClock.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/JCacheMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/lang/NonNullFields.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/HistogramSnapshot.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/Tags.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/pause/NoPauseDetector.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/system/ProcessorMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/internal/TimedExecutor.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/MeterRegistry.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/package-info.java

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/aop/CountedAspect.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/step/StepRegistryConfig.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/internal/Mergeable.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/package-info.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/Metrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/internal/DefaultGauge.java  
\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/cumulative/CumulativeTimer.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/cache/EhCache2Metrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/AbstractDistributionSummary.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/composite/CompositeDistributionSummary.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/push/package-info.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/distribution/Histogram.java  
\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/util/MeterPartition.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/util/StringEscapeUtils.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/db/DatabaseTableMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/simple/package-info.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/TimeGauge.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/ImmutableTag.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/internal/TimedExecutorService.java  
\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/aop/TimedAspect.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/Tag.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/Gauge.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-

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jar/io/micrometer/core/instrument/dropwizard/DropwizardFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jvm/ClassLoaderMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/GuavaCacheMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/FunctionTimer.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepFunctionCounter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/ValueAtPercentile.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/HazelcastCacheMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/cumulative/CumulativeDistributionSummary.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jvm/JvmThreadMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jpa/HibernateMetrics.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/CaffeineCacheMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/HistogramGauges.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardRate.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/dropwizard/DropwizardGauge.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/config/MeterRegistryConfig.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisher.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/composite/CompositeFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepMeasurement.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/AbstractMeter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/pause/ClockDriftPauseDetector.java

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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/Counter.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/lang/NonNull.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/tomcat/TomcatMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/lang/NonNullApi.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/FunctionCounter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/annotation/Counted.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionCounter.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/HistogramSupport.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/simple/CountingMode.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/TimeUtils.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/lang/Nullable.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/annotation/Timed.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopGauge.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/search/RequiredSearch.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/db/PostgreSQLDatabaseMetrics.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/StringUtils.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/BaseUnits.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/TimeWindowFixedBoundaryHistogram.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/pause/PauseDetector.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/annotation/Incubating.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/config/package-info.java
*

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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/pause/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/NoopHistogram.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepLong.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/search/Search.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisherCommand.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/IOUtils.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/system/UptimeMetrics.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/MeterEquivalence.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jvm/JvmCompilationMetrics.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/Clock.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepFunctionTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/okhttp3/OkHttpMetricsEventListener.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/DistributionSummary.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/Meter.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/config/MissingRequiredConfigurationException.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopFunctionCounter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/Statistic.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/MeterBinder.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/util/HierarchicalNameMapper.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/internal/package-info.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/distribution/PercentileHistogramBuckets.java
*
/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/config/InvalidConfigurationException.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-

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jar/io/micrometer/core/instrument/dropwizard/DropwizardTimer.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/step/StepDouble.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/jvm/JvmMemoryMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/system/FileDescriptorMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/noop/NoopDistributionSummary.java  
\*  
/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/search/package-info.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/cumulative/package-info.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/composite/CompositeCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/util/AbstractPartition.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/dropwizard/DropwizardCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/distribution/CountAtBucket.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/annotation/TimedSet.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/jvm/ExecutorServiceMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/composite/CompositeMeterRegistry.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/cumulative/CumulativeCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/composite/CompositeGauge.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/composite/package-info.java  
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jar/io/micrometer/core/instrument/binder/jvm/JvmGcMetrics.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/AbstractTimer.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/noop/NoopCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/hytrix/MicrometerMetricsPublisherThreadPool.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/step/StepDistributionSummary.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/distribution/DistributionStatisticConfig.java

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* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/step/StepMeterRegistry.java
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jar/io/micrometer/core/instrument/logging/package-info.java
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jar/io/micrometer/core/instrument/internal/DefaultMeter.java
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jar/io/micrometer/core/instrument/simple/SimpleConfig.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/noop/NoopTimeGauge.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/logging/Log4j2Metrics.java
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jar/io/micrometer/core/instrument/Measurement.java
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jar/io/micrometer/core/instrument/internal/DefaultLongTaskTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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jar/io/micrometer/core/instrument/distribution/AbstractTimeWindowHistogram.java
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jar/io/micrometer/core/instrument/noop/NoopLongTaskTimer.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
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jar/io/micrometer/core/instrument/dropwizard/DropwizardMeterRegistry.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/LongTaskTimer.java
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/opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/cache/CacheMeterBinder.java
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jar/io/micrometer/core/instrument/composite/CompositeMeter.java
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jar/io/micrometer/core/instrument/util/DoubleFormat.java
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jar/io/micrometer/core/instrument/config/MeterFilter.java
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jar/io/micrometer/core/instrument/step/StepCounter.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/simple/SimpleMeterRegistry.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-

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jar/io/micrometer/core/instrument/step/StepTimer.java  
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/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/step/package-info.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/composite/CompositeFunctionCounter.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/config/MeterFilterReply.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/MockClock.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/logging/LogbackMetrics.java  
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jar/io/micrometer/core/instrument/binder/http/HttpServletRequestTagsProvider.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/kafka/KafkaMetrics.java  
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jar/io/micrometer/core/instrument/config/validate/InvalidReason.java  
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jar/io/micrometer/core/instrument/binder/httpcomponents/DefaultUriMapper.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/step/StepTuple2.java  
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jar/io/micrometer/core/instrument/distribution/TimeWindowSum.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/db/JooqExecuteListener.java  
\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-  
jar/io/micrometer/core/instrument/binder/http/HttpRequestTags.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/config/MeterRegistryConfigValidator.java

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/jetty/JettyClientTags.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/http/Outcome.java

\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/config/validate/ValidationException.java

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/http/DefaultHttpServletRequestTagsProvider.java

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jar/io/micrometer/core/instrument/binder/kafka/KafkaStreamsMetrics.java

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jar/io/micrometer/core/util/internal/logging/FormattingTuple.java

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\* /opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/instrument/binder/jetty/TimedHandler.java  
\*

/opt/cola/permits/1621407470\_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-jar/io/micrometer/core/util/internal/logging/WarnThenDebugLogger.java

```
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jetty/OnCompletionAsyncListener.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jetty/InstrumentedQueuedThreadPool.java
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/binder/jvm/JvmMemory.java
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```
* /opt/cola/permits/1621407470_1681872601.2356467/0/micrometer-core-1-5-4-sources-1-
jar/io/micrometer/core/instrument/internal/OnlyOnceLoggingDenyMeterFilter.java
```

## 1.348 libxml2 2.9.10+dfsg-5ubuntu0.20.04.6

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## 1.349 spring-aspects 5.2.24.RELEASE

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* /opt/cola/permits/1651261826_1682398097.451441/0/spring-aspects-5-2-24-release-sources-
jar/org/springframework/beans/factory/aspectj/GenericInterfaceDrivenDependencyInjectionAspect.aj
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  - \* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/transaction/aspectj/JtaAnnotationTransactionAspect.aj
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  - \* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/cache/aspectj/AbstractCacheAspect.aj
  - \*
  - \* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/cache/aspectj/JCacheCacheAspect.aj
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  - \* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/transaction/aspectj/AspectJJaTransactionManagementConfiguration.java
  - \*
  - /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/transaction/aspectj/AbstractTransactionAspect.aj
  - \* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/beans/factory/aspectj/AnnotationBeanConfigurerAspect.aj
  - \* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/scheduling/aspectj/AspectJAsyncConfiguration.java
  - \* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/beans/factory/aspectj/AbstractInterfaceDrivenDependencyInjectionAspect.aj
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\* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/cache/aspectj/AspectJCacheConfiguration.java  
\*  
/opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/cache/aspectj/AspectJCacheConfiguration.java  
\* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/cache/aspectj/AnyThrow.java  
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\* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/scheduling/aspectj/AnnotationAsyncExecutionAspect.aj  
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\* /opt/cola/permits/1651261826\_1682398097.451441/0/spring-aspects-5-2-24-release-sources-jar/org/springframework/beans/factory/aspectj/ConfigurableObject.java

# 1.350 spring-web 5.2.24.RELEASE

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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/context/request/RequestContextListener.java  
\*

```
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/bind/support/SpringWebConstraintValidatorFactory.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/client/AbstractClientHttpRequestFactoryWrapper.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/bind/annotation/SessionAttributes.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/converter/HttpMessageConversionException.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/HttpSessionMutexListener.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/server/WebFilter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/filter/CommonsRequestLoggingFilter.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/filter/RequestContextFilter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/HttpMessage.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/converter/HttpMessageNotWritableException.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/multipart/MultipartResolver.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/server/WebFilterChain.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/context/request/DestructionCallbackBindingListener.java
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jar/org/springframework/http/converter/xml/SourceHttpMessageConverter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/accept/MediaTypeFileExtensionResolver.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/converter/xml/AbstractJaxb2HttpMessageConverter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/context/support/GenericWebApplicationContext.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/codec/ResourceHttpMessageWriter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/context/support/AnnotationConfigWebApplicationContext.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/pattern/InternalPathPatternParser.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/HtmlCharacterEntityDecoder.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/multipart/support/MultipartResolutionDelegate.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/server/reactive/ChannelSendOperator.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/codec/support/ServerDefaultCodecsImpl.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/CacheControl.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/bind/annotation/RestControllerAdvice.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
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jar/org/springframework/http/server/reactive/AbstractListenerWriteFlushProcessor.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/server/handler/WebHandlerDecorator.java  
\*  
/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/client/reactive/ClientHttpResponse.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/filter/reactive/ServerWebExchangeContextFilter.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/server/reactive/AbstractServerHttpRequest.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/cors/UrlBasedCorsConfigurationSource.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/client/UnknownHttpStatusException.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/method/annotation/AbstractWebArgumentResolverAdapter.java  
\*  
/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/codec/cbor/Jackson2CborEncoder.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/server/reactive/AbstractListenerReadPublisher.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/context/request/async/DeferredResult.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/client/HttpServerErrorException.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/client/HttpStatusException.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/codec/cbor/Jackson2CborDecoder.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/method/support/AsyncHandlerMethodReturnValueHandler.java  
\*  
/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/context/support/RequestHandledEvent.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/server/session/InMemoryWebSessionStore.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/HttpStatus.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/converter/ByteArrayHttpMessageConverter.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/converter/cbor/MappingJackson2CborHttpMessageConverter.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/server/ServerWebExchangeDecorator.java  
\*  
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jar/org/springframework/http/codec/protobuf/ProtobufEncoder.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-

jar/org/springframework/http/codec/support/DefaultClientCodecConfigurer.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
 jar/org/springframework/web/util/UriUtils.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
 jar/org/springframework/http/HttpRange.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
 jar/org/springframework/web/method/annotation/ModelFactory.java  
 \* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
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*/
/**
* Return the web session for the current request. Always guaranteed to
* return an instance either matching to the session id requested by the
* client, or with a new session id either because the client did not
* specify one or because the underlying session had expired. Use of this
* method
does not automatically create a session. See { @link WebSession }
* for more details.
*/
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jar/org/springframework/web/HttpMediaTypeException.java

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jar/org/springframework/web/util/pattern/CaptureTheRestPathElement.java
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* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
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* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
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* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
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* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/server/ServerHttpAsyncRequestControl.java
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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/converter/xml/AbstractXmlHttpMessageConverter.java

\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/multipart/support/StandardMultipartHttpServletRequest.java

\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/server/ServerErrorException.java

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/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/http/StreamingHttpOutputMessage.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-  
jar/org/springframework/web/bind/ServletRequestParameterPropertyValues.java  
\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-

```

jar/org/springframework/remoting/jaxws/SimpleHttpServerJaxWsServiceExporter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/codec/CodecConfigurerFactory.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/TagUtils.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/codec/LoggingCodecSupport.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/codec/protobuf/ProtobufCodecSupport.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/method/annotation/InitBinderDataBinderFactory.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/DefaultUriTemplateHandler.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/jsp/DelegatingNavigationHandlerProxy.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/server/ServletServerHttpResponse.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/filter/GenericFilterBean.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/server/DefaultRequestPath.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/cors/CorsProcessor.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/multipart/support/StandardServletMultipartResolver.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/remoting/caucho/HessianExporter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/multipart/support/DefaultMultipartHttpServletRequest.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/codec/HttpMessageEncoder.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/filter/RelativeRedirectFilter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/context/request/async/WebAsyncTask.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/InvalidMediaTypeException.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/HttpRequest.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/remoting/caucho/HessianServiceExporter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/HttpRequestMethodNotSupportedException.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/method/annotation/RequestParamMapMethodArgumentResolver.java

```

```

* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/converter/protobuf/ExtensionRegistryInitializer.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/JavaScriptUtils.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/server/reactive/ReactorHttpHandlerAdapter.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/client/support/AsyncHttpAccessor.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/codec/HttpMessageReader.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/remoting/httpinvoker/SimpleHttpInvokerRequestExecutor.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/HttpEntity.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/server/DefaultServerWebExchangeBuilder.java
*
/opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/client/support/BasicAuthorizationInterceptor.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/context/request/FacesRequestAttributes.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/util/OpaqueUriComponents.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/http/server/reactive/ContextPathCompositeHandler.java
No license file was found, but licenses were detected in source scan.

```

```

This file maps Internet media types to unique file extension(s).
Although created for httpd, this file is used by many software systems
and has been placed in the public domain for unlimited redistribution.
#
The table below contains both registered and (common) unregistered types.
A type that has no unique extension can be ignored -- they are listed
here to guide configurations toward known types and to make it easier to
identify "new" types. File extensions are also commonly used to indicate
content languages and encodings, so choose them carefully.
#
Internet media types should be registered as described in RFC 4288.
The registry is at <https://www.iana.org/assignments/media-types/>.
#
This file was retrieved from
https://svn.apache.org/viewvc/httpd/httpd/trunk/docs/conf/mime.types?revision=1752884&view=co
#
MIME type (lowercased) Extensions
=====
#

```

application/1d-interleaved-parityfec  
# application/3gpdash-qoe-report+xml  
# application/3gpp-ims+xml  
# application/a2l  
# application/activemessage  
# application/alto-costmap+json  
# application/alto-costmapfilter+json  
# application/alto-directory+json  
# application/alto-endpointcost+json  
# application/alto-endpointcostparams+json  
# application/alto-endpointprop+json  
# application/alto-endpointpropparams+json  
# application/alto-error+json  
# application/alto-networkmap+json  
# application/alto-networkmapfilter+json  
# application/aml  
application/andrew-inset ez  
# application/applefile  
application/applixware aw  
# application/atf  
# application/atfx  
application/atom+xml atom  
application/atomcat+xml atomcat  
# application/atomdeleted+xml  
# application/atomicmail  
application/atomsvc+xml atomsvc  
# application/atxml  
# application/auth-policy+xml  
# application/bacnet-xdd+zip  
# application/batch-smtp  
# application/beep+xml  
# application/calendar+json  
# application/calendar+xml  
#  
application/call-completion  
# application/cals-1840  
# application/cbor  
# application/ccmp+xml  
application/ccxml+xml ccxml  
# application/cdfx+xml  
application/cdmi-capability cdmia  
application/cdmi-container cdmic  
application/cdmi-domain cdmid  
application/cdmi-object cdmio  
application/cdmi-queue cdmiq  
# application/cdni  
# application/cea  
# application/cea-2018+xml

# application/cellml+xml  
# application/cfw  
# application/cms  
# application/cnrx+xml  
# application/coap-group+json  
# application/commonground  
# application/conference-info+xml  
# application/cpl+xml  
# application/csrattrs  
# application/csta+xml  
# application/cstadata+xml  
# application/csvm+json  
application/cu-seeme cu  
# application/cybercash  
# application/dash+xml  
# application/dashdelta  
application/davmount+xml davmount  
# application/dca-rft  
# application/dcd  
# application/dec-dx  
# application/dialog-info+xml  
# application/dicom  
# application/dii  
# application/dit  
# application/dns  
application/docbook+xml dbk  
#  
application/dskpp+xml  
application/dssc+der dssc  
application/dssc+xml xdssc  
# application/dvcs  
application/ecmascript ecma  
# application/edi-consent  
# application/edi-x12  
# application/edifact  
# application/efi  
# application/emergencycalldata.comment+xml  
# application/emergencycalldata.deviceinfo+xml  
# application/emergencycalldata.providerinfo+xml  
# application/emergencycalldata.serviceinfo+xml  
# application/emergencycalldata.subscriberinfo+xml  
application/emma+xml emma  
# application/emotionml+xml  
# application/encaprtp  
# application/epp+xml  
application/epub+zip epub  
# application/eshop  
# application/example

application/exi exi  
# application/fastinfoset  
# application/fastsoap  
# application/fdt+xml  
# application/fits  
# application/font-sfnt  
application/font-tdpfr pfr  
application/font-woff woff  
# application/framework-attributes+xml  
# application/geo+json  
application/gml+xml gml  
application/gpx+xml gpx  
application/gxf gxf  
# application/gzip  
#  
application/h224  
# application/held+xml  
# application/http  
application/hyperstudio stk  
# application/ibe-key-request+xml  
# application/ibe-pkg-reply+xml  
# application/ibe-pp-data  
# application/iges  
# application/im-iscomposing+xml  
# application/index  
# application/index.cmd  
# application/index.obj  
# application/index.response  
# application/index.vnd  
application/inkml+xml ink inkml  
# application/iotp  
application/ipfix ipfix  
# application/ipp  
# application/isup  
# application/its+xml  
application/java-archive jar  
application/java-serialized-object ser  
application/java-vm class  
application/javascript js  
# application/jose  
# application/jose+json  
# application/jrd+json  
application/json json  
# application/json-patch+json  
# application/json-seq  
application/jsonml+json jsonml  
# application/jwk+json  
# application/jwk-set+json

```
application/jwt
application/kpml-request+xml
application/kpml-response+xml
application/ld+json
application/lgr+xml
application/link-format
#
 application/load-control+xml
application/lost+xml lostxml
application/lostsync+xml
application/lxf
application/mac-binhex40 hqx
application/mac-compactpro cpt
application/macwriteii
application/mads+xml mads
application/marc mrc
application/marcxml+xml mrcx
application/mathematica ma nb mb
application/mathml+xml mathml
application/mathml-content+xml
application/mathml-presentation+xml
application/mbms-associated-procedure-description+xml
application/mbms-deregister+xml
application/mbms-envelope+xml
application/mbms-msk+xml
application/mbms-msk-response+xml
application/mbms-protection-description+xml
application/mbms-reception-report+xml
application/mbms-register+xml
application/mbms-register-response+xml
application/mbms-schedule+xml
application/mbms-user-service-description+xml
application/mbox mbox
application/media-policy-dataset+xml
application/media_control+xml
application/mediaservercontrol+xml mscml
application/merge-patch+json
application/metalink+xml metalink
application/metalink4+xml meta4
application/mets+xml mets
#
 application/mf4
application/mikey
application/mods+xml mods
application/moss-keys
application/moss-signature
application/mosskey-data
application/mosskey-request
```

application/mp21 m21 mp21  
application/mp4 mp4s  
# application/mpeg4-generic  
# application/mpeg4-iod  
# application/mpeg4-iod-xmt  
# application/mrb-consumer+xml  
# application/mrb-publish+xml  
# application/msc-ivr+xml  
# application/msc-mixer+xml  
application/msword doc dot  
application/mxf mxf  
# application/nasdata  
# application/news-checkgroups  
# application/news-groupinfo  
# application/news-transmission  
# application/nlsm1+xml  
# application/nss  
# application/ocsp-request  
# application/ocsp-response  
application/octet-stream bin dms lrf mar so dist distz pkg bpk dump elc deploy  
application/oda oda  
# application/odx  
application/obeps-package+xml opf  
application/ogg ogx  
application/omdoc+xml omdoc  
application/onenote onetoc  
onetoc2 onetmp onepkg  
application/oxps oxps  
# application/p2p-overlay+xml  
# application/parityfec  
application/patch-ops-error+xml xer  
application/pdf pdf  
# application/pdx  
application/pgp-encrypted pgp  
# application/pgp-keys  
application/pgp-signature asc sig  
application/pics-rules prf  
# application/pidf+xml  
# application/pidf-diff+xml  
application/pkcs10 p10  
# application/pkcs12  
application/pkcs7-mime p7m p7c  
application/pkcs7-signature p7s  
application/pkcs8 p8  
application/pkix-attr-cert ac  
application/pkix-cert cer  
application/pkix-crl crl  
application/pkix-pkipath pkipath



application/pkixcmp pki  
application/pls+xml pls  
# application/poc-settings+xml  
application/postscript ai eps ps  
# application/ppsp-tracker+json  
# application/problem+json  
# application/problem+xml  
# application/provenance+xml  
# application/prs.alvestrand.titrax-sheet  
application/prs.cww cww  
# application/prs.hpub+zip  
#  
application/prs.nprend  
# application/prs.plucker  
# application/prs.rdf+xml-crypt  
# application/prs.xsf+xml  
application/pskc+xml pskcxml  
# application/qsig  
# application/raptorfec  
# application/rdap+json  
application/rdf+xml rdf  
application/reginfo+xml rif  
application/relax-ng-compact-syntax rnc  
# application/remote-printing  
# application/reputon+json  
application/resource-lists+xml rl  
application/resource-lists-diff+xml rld  
# application/rfc+xml  
# application/riscos  
# application/rlmi+xml  
application/rls-services+xml rs  
application/rpki-ghostbusters gbr  
application/rpki-manifest mft  
application/rpki-roa roa  
# application/rpki-updown  
application/rsd+xml rsd  
application/rss+xml rss  
application/rtf rtf  
# application/rtploopback  
# application/rtx  
# application/samlassertion+xml  
# application/samlmetadata+xml  
application/sbml+xml sbml  
# application/scaip+xml  
# application/scim+json  
application/scvp-cv-request scq  
application/scvp-cv-response scs  
application/scvp-vp-request spq

application/scvp-vp-response spp  
application/sdp sdp  
#  
application/sep+xml  
# application/sep-exi  
# application/session-info  
# application/set-payment  
application/set-payment-initiation setpay  
# application/set-registration  
application/set-registration-initiation setreg  
# application/sgml  
# application/sgml-open-catalog  
application/shf+xml shf  
# application/sieve  
# application/simple-filter+xml  
# application/simple-message-summary  
# application/simplesymbolcontainer  
# application/slate  
# application/smil  
application/smil+xml smi smil  
# application/smpite336m  
# application/soap+fastinfoset  
# application/soap+xml  
application/sparql-query rq  
application/sparql-results+xml srx  
# application/spirits-event+xml  
# application/sql  
application/srgs gram  
application/srgs+xml grxml  
application/sru+xml sru  
application/ssdl+xml ssdl  
application/ssml+xml ssml  
# application/tamp-apex-update  
# application/tamp-apex-update-confirm  
# application/tamp-community-update  
#  
application/tamp-community-update-confirm  
# application/tamp-error  
# application/tamp-sequence-adjust  
# application/tamp-sequence-adjust-confirm  
# application/tamp-status-query  
# application/tamp-status-response  
# application/tamp-update  
# application/tamp-update-confirm  
application/tei+xml tei teicorpus  
application/thraud+xml tfi  
# application/timestamp-query  
# application/timestamp-reply

```

application/timestamped-data tsd
application/ttml+xml
application/tve-trigger
application/ulpfec
application/urc-grpsheet+xml
application/urc-ressheet+xml
application/urc-targetdesc+xml
application/urc-uisocketdesc+xml
application/vcard+json
application/vcard+xml
application/vemmi
application/vividence.scriptfile
application/vnd.3gpp-prose+xml
application/vnd.3gpp-prose-pc3ch+xml
application/vnd.3gpp.access-transfer-events+xml
application/vnd.3gpp.bsf+xml
application/vnd.3gpp.mid-call+xml
application/vnd.3gpp.pic-bw-large plb
application/vnd.3gpp.pic-bw-small psb
application/vnd.3gpp.pic-bw-var pvb
#
application/vnd.3gpp.sms
application/vnd.3gpp.sms+xml
application/vnd.3gpp.srvcc-ext+xml
application/vnd.3gpp.srvcc-info+xml
application/vnd.3gpp.state-and-event-info+xml
application/vnd.3gpp.ussd+xml
application/vnd.3gpp2.bcsmcinfo+xml
application/vnd.3gpp2.sms
application/vnd.3gpp2.tcap tcap
application/vnd.3lightssoftware.imagescal
application/vnd.3m.post-it-notes pwn
application/vnd.accpac.simply.aso aso
application/vnd.accpac.simply.imp imp
application/vnd.acucobol acu
application/vnd.acucorp atc acutc
application/vnd.adobe.air-application-installer-package+zip air
application/vnd.adobe.flash.movie
application/vnd.adobe.formscentral.fcdt fcdt
application/vnd.adobe.fxp fxp fxpl
application/vnd.adobe.partial-upload
application/vnd.adobe.xdp+xml xdp
application/vnd.adobe.xfdf xfdf
application/vnd.aether.imp
application/vnd.ah-barcode
application/vnd.ahead.space ahead
application/vnd.airzip.filesecure.azf azf
application/vnd.airzip.filesecure.azs azs

```

application/vnd.amazon.ebook azw  
#  
application/vnd.amazon.mobi8-ebook  
application/vnd.americandynamics.acc acc  
application/vnd.amiga.ami ami  
# application/vnd.amundsen.maze+xml  
application/vnd.android.package-archive apk  
# application/vnd.anki  
application/vnd.anser-web-certificate-issue-initiation cii  
application/vnd.anser-web-funds-transfer-initiation fti  
application/vnd.antix.game-component atx  
# application/vnd.apache.thrift.binary  
# application/vnd.apache.thrift.compact  
# application/vnd.apache.thrift.json  
# application/vnd.api+json  
application/vnd.apple.installer+xml mpkg  
application/vnd.apple.mpegurl m3u8  
# application/vnd.arastra.swi  
application/vnd.aristanetworks.swi swi  
# application/vnd.artsquare  
application/vnd.astraea-software.iota iota  
application/vnd.audiograph aep  
# application/vnd.autopackage  
# application/vnd.avistar+xml  
# application/vnd.balsamiq.bmml+xml  
# application/vnd.balsamiq.bmpr  
#  
application/vnd.bekitzur-stech+json  
# application/vnd.biopax.rdf+xml  
application/vnd.blueice.multipass mpm  
# application/vnd.bluetooth.ep.oob  
# application/vnd.bluetooth.le.oob  
application/vnd.bmi bmi  
application/vnd.businessobjects rep  
# application/vnd.cab-jscript  
# application/vnd.canon-cpdl  
# application/vnd.canon-lips  
# application/vnd.cendio.thinlinc.clientconf  
# application/vnd.century-systems.tcp\_stream  
application/vnd.chemdraw+xml cdxml  
# application/vnd.chess-pgn  
application/vnd.chipnuts.karaoke-mmd mmd  
application/vnd.cinderella cdy  
# application/vnd.cirpack.isdn-ext  
# application/vnd.citationstyles.style+xml  
application/vnd.claymore cla  
application/vnd.cloanto.rp9 rp9  
application/vnd.clonk.c4group c4g c4d c4f c4p c4u

application/vnd.cluetrust.cartomobile-config c11amc  
application/vnd.cluetrust.cartomobile-config-pkg c11amz  
# application/vnd.coffeescript  
# application/vnd.collection+json  
# application/vnd.collection.doc+json  
# application/vnd.collection.next+json  
#  
application/vnd.comicbook+zip  
# application/vnd.commerce-battelle  
application/vnd.commonspace csp  
application/vnd.contact.cmsg cdbcmsg  
# application/vnd.coreos.ignition+json  
application/vnd.cosmocaller cmc  
application/vnd.crick.clicker clkx  
application/vnd.crick.clicker.keyboard clkk  
application/vnd.crick.clicker.palette clkp  
application/vnd.crick.clicker.template clkt  
application/vnd.crick.clicker.wordbank clkw  
application/vnd.criticaltools.wbs+xml wbs  
application/vnd.ctc-posml pml  
# application/vnd.ctct.ws+xml  
# application/vnd.cups-pdf  
# application/vnd.cups-postscript  
application/vnd.cups-ppd ppd  
# application/vnd.cups-raster  
# application/vnd.cups-raw  
# application/vnd.curl  
application/vnd.curl.car car  
application/vnd.curl.pcurl pcurl  
# application/vnd.cyan.dean.root+xml  
# application/vnd.cybank  
application/vnd.dart dart  
application/vnd.data-vision.rdz rdz  
# application/vnd.debian.binary-package  
application/vnd.dece.data uvf uvvf  
uvd uvvd  
application/vnd.dece.ttml+xml uvt uvvt  
application/vnd.dece.unspecified uvx uvvx  
application/vnd.dece.zip uvz uvvz  
application/vnd.denovo.fcselayout-link fe\_launch  
# application/vnd.desmume.movie  
# application/vnd.dir-bi.plate-dl-nosuffix  
# application/vnd.dm.delegation+xml  
application/vnd.dna dna  
# application/vnd.document+json  
application/vnd.dolby.mlp mlp  
# application/vnd.dolby.mobile.1  
# application/vnd.dolby.mobile.2

```
application/vnd.doremir.scorecloud-binary-document
application/vnd.dpgraph dpg
application/vnd.dreamfactory dfac
application/vnd.drive+json
application/vnd.ds-keypoint kpxx
application/vnd.dtg.local
application/vnd.dtg.local.flash
application/vnd.dtg.local.html
application/vnd.dvb.ait ait
application/vnd.dvb.dvbj
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application/vnd.geospace g3w  
# application/vnd.gerber  
# application/vnd.globalplatform.card-content-mgt  
# application/vnd.globalplatform.card-content-mgt-response  
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# application/vnd.hdt  
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# application/vnd.ibm.electronic-media  
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icm  
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```

```
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# application/vnd.oma.cab-pcc+xml  
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# application/vnd.osa.netdeploy  
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# application/vnd.powerbuilder6-s  
# application/vnd.powerbuilder7  
# application/vnd.powerbuilder7-s  
# application/vnd.powerbuilder75  
# application/vnd.powerbuilder75-s  
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# application/vnd.pwg-xhtml-print+xml  
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#
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application/vnd.sbm.mid2
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# application/vnd.syncml.dm.notification  
# application/vnd.syncml.dmddf+wbxml  
# application/vnd.syncml.dmddf+xml

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application/vnd.tao.intent-module-archive tao
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application/vnd.uplanet.channel
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```

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application/voicexml+xml vxml  
# application/vq-rtcpvr  
# application/watcherinfo+xml  
# application/whoispp-query  
# application/whoispp-response

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application/winhelp hlp  
# application/wita  
# application/wordperfect5.1  
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application/wspolicy+xml wspolicy  
application/x-7z-compressed 7z  
application/x-abiword abw  
application/x-ace-compressed ace  
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application/x-authorware-map aam  
application/x-authorware-seg aas  
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application/x-bittorrent torrent  
application/x-blorb blb blorb  
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application/x-bzip2 bz2 boz  
application/x-cbr cbr cba cbt cbz cb7  
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application/x-chess-pgn pgn  
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application/x-mscardfile crd  
application/x-msclip clp  
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# image/jls  
# image/jp2

image/jpeg jpeg jpg jpe  
# image/jpm  
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# image/naplps  
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fhc fh4 fh5 fh7  
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# message/sipfrag  
# message/tracking-status  
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model/x3d+vrml x3dv x3dvz  
model/x3d+xml x3d x3dz  
# model/x3d-vrml  
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# multipart/appledouble  
# multipart/byteranges  
# multipart/digest  
# multipart/encrypted  
# multipart/example  
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# multipart/header-set  
# multipart/mixed  
# multipart/parallel  
# multipart/related  
# multipart/report  
# multipart/signed  
# multipart/voice-message  
# multipart/x-mixed-replace  
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text/cache-manifest appcache  
text/calendar ics ifb  
text/css css  
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# text/csv-schema  
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text/directory  
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# text/encaprtpt  
# text/enriched  
# text/example  
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# text/grammar-ref-list  
text/html html htm  
# text/javascript

# text/jcr-cnd  
# text/markdown  
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video/mp1s
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# video/mp4v-es  
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# video/mpeg4-generic  
# video/mpv  
# video/nv  
video/ogg ogv  
# video/parityfec  
# video/pointer  
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x-conference/x-cooltalk ice

#### Found

in path(s):

\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/mime.types

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Found in path(s):

\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/bind/annotation/Mapping.java

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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/multipart/MultipartHttpServletRequest.java

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\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/converter/json/JsonbHttpMessageConverter.java

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/opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/http/client/reactive/ReactorClientHttpResponse.java

\* /opt/cola/permits/1651261875\_1682321527.3407862/0/spring-web-5-2-24-release-sources-jar/org/springframework/web/cors/DefaultCorsProcessor.java

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jar/org/springframework/web/cors/reactive/DefaultCorsProcessor.java
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jar/org/springframework/http/server/reactive/ServerHttpResponse.java
* /opt/cola/permits/1651261875_1682321527.3407862/0/spring-web-5-2-24-release-sources-
jar/org/springframework/web/client/RestTemplate.java
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jar/org/springframework/web/context/request/WebRequest.java
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jar/org/springframework/http/server/reactive/ServletServerHttpResponse.java
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jar/org/springframework/http/client/support/InterceptingHttpAccessor.java
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* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/SpelCompiler.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/MethodReference.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/ReflectivePropertyAccessor.java
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/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/ReflectiveConstructorResolver.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Elvis.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpDec.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Identifier.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Ternary.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/TypeReference.java  
\*  
/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpGE.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/InlineMap.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/TypeCode.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/Tokenizer.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpOr.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/FloatLiteral.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Literal.java  
\*  
/opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/StandardTypeComparator.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OperatorInstanceof.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpModulus.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpGT.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/Operator.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/OpLE.java  
\* /opt/cola/permits/1651261883\_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/BooleanLiteral.java

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```
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/SpelMessage.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/PropertyOrFieldReference.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ExpressionState.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/Indexer.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/OpPlus.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/SpelNodeImpl.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/EvaluationContext.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/standard/InternalSpelExpressionParser.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/OperatorMatches.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/SimpleEvaluationContext.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/OpMultiply.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/CompoundExpression.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/Assign.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
```

jar/org/springframework/expression/spel/ast/VariableReference.java  
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```
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/InternalParseException.java
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```
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/CompilablePropertyAccessor.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/standard/SpelExpressionParser.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/SpelCompilerMode.java
```

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```
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/StandardEvaluationContext.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/common/TemplateAwareExpressionParser.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/SpelEvaluationException.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/ast/FormatHelper.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/ReflectiveMethodResolver.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/SpelNode.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/StandardTypeConverter.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/TypedValue.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/DataBindingMethodResolver.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/ReflectionHelper.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/StandardOperatorOverloader.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/ReflectiveMethodExecutor.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/common/LiteralExpression.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
```

```

jar/org/springframework/expression/ExpressionException.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/common/CompositeStringExpression.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/DataBindingPropertyAccessor.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/Operation.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/CodeFlow.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-
jar/org/springframework/expression/spel/support/BooleanTypedValue.java

```

# 1.352 spring-context 5.2.24.RELEASE

## 1.352.1 Available under license :

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*/
/**
* Indicates that a component is only eligible for registration when all
* { @linkplain #value specified conditions } match.
*
* <p>A condition is any state that can be determined programmatically
* before the bean definition is due to be registered (see { @link Condition } for details).
*
*
* <p>The { @code @Conditional } annotation may be used in any of the following ways:
*
* as a type-level annotation on any class directly or indirectly annotated with
* { @code @Component }, including { @link Configuration @Configuration } classes
* as a meta-annotation, for the purpose of composing custom stereotype
* annotations

```

- \* <li>as a method-level annotation on any { @link Bean @Bean } method</li>
- \* </ul>
- \*
- \* <p>If a { @code @Configuration } class is marked with { @code @Conditional },
- \* all of the { @code @Bean } methods, { @link Import @Import } annotations, and
- \* { @link ComponentScan @ComponentScan } annotations associated with that
- \* class will be subject to the conditions.
- \*
- \* <p><strong>NOTE</strong>: Inheritance of { @code @Conditional } annotations
- \* is not supported; any conditions from superclasses or from overridden
- \* methods will not be considered. In order to enforce these semantics,
- \* { @code @Conditional } itself is not declared as
- \* { @link java.lang.annotation.Inherited
- @Inherited }; furthermore, any
- \* custom <em>composed annotation</em> that is meta-annotated with
- \* { @code @Conditional } must not be declared as { @code @Inherited }.
- \*
- \* @author Phillip Webb
- \* @author Sam Brannen
- \* @since 4.0
- \* @see Condition
- \*/

Found in path(s):

- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/annotation/Conditional.java

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- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/annotation/ConflictingBeanDefinitionException.java

- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/context/annotation/ImportAware.java

\*

/opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/jmx/export/notification/NotificationPublisherAware.java

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jar/org/springframework/format/datetime/joda/ReadablePartialPrinter.java

\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/format/datetime/joda/DateTimeParser.java

\*

/opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/format/datetime/joda/LocalTimeParser.java

\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/context/i18n/LocaleContext.java

\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/format/datetime/joda/ReadableInstantPrinter.java

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jar/org/springframework/format/datetime/joda/LocalDateTimeParser.java

\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/context/support/MessageSourceResourceBundle.java

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jar/org/springframework/scheduling/concurrent/CustomizableThreadFactory.java

\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/validation/beanvalidation/OptionalValidatorFactoryBean.java

\*

/opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/context/annotation/FilterType.java

\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

jar/org/springframework/format/datetime/joda/MillisecondInstantPrinter.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
jar/org/springframework/context/annotation/Description.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
jar/org/springframework/context/i18n/TimeZoneAwareLocaleContext.java  
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jar/org/springframework/format/datetime/joda/LocalDateParser.java  
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jar/org/springframework/remoting/support/RemoteInvocationBasedAccessor.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/context/config/ContextNamespaceHandler.java
*
/opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/context/support/LiveBeansViewMBean.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/remoting/support/RemoteInvocationTraceInterceptor.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/ui/context/support/UiApplicationContextUtils.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/context/weaving/LoadTimeWeaverAware.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/jmx/export/annotation/AnnotationMBeanExporter.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/scheduling/TriggerContext.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/scheduling/config/TaskNamespaceHandler.java
*
/opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/jmx/export/naming/SelfNaming.java
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\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/config/SpringConfiguredBeanDefinitionParser.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/ejb/config/LocalStatelessSessionBeanDefinitionParser.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/jmx/export/MBeanExportException.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/jndi/JndiLookupFailureException.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/remoting/soap/SoapFaultException.java  
\*  
/opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/remoting/RemoteConnectFailureException.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/ui/context/ThemeSource.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/validation/BindingResultUtils.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/Phased.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/jmx/access/InvocationFailureException.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/event/ContextRefreshedEvent.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/scheduling/support/DelegatingErrorHandlingRunnable.java  
\*  
/opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/validation/MessageCodesResolver.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/annotation/ScopeMetadata.java  
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/\*\*

\* Abstract the invocation of a cache operation.  
\*  
\* <p>Does not provide a way to transmit checked exceptions but  
\* provide a special exception that should be used to wrap any  
\* exception that was thrown by the underlying invocation.  
\* Callers are expected to handle this issue type specifically.  
\*  
\* @author Stephane Nicoll  
\* @since 4.1  
\*/

Found in path(s):

\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/cache/interceptor/CacheOperationInvoker.java

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jar/org/springframework/format/datetime/joda/PeriodFormatter.java
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jar/org/springframework/remoting/RemoteTimeoutException.java
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/**

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```

* {@link FactoryBean} that obtains a WebSphere {@link javax.management.MBeanServer}
* reference through WebSphere's proprietary {@code AdminServiceFactory} API,
* available on WebSphere 5.1 and higher.
*
* <p>Exposes the {@code MBeanServer} for bean references.
*
* <p>This {@code FactoryBean} is
a direct alternative to {@link MBeanServerFactoryBean},
* which uses standard JMX 1.2 API to access the platform's {@link MBeanServer}.
*
* <p>See the javadocs for WebSphere's
* <a
href="https://www.ibm.com/support/knowledgecenter/SSEQTJ_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs
/com/ibm/websphere/management/AdminServiceFactory.html">{@code AdminServiceFactory}
* and
* <a
href="https://www.ibm.com/support/knowledgecenter/SSEQTJ_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs
/com/ibm/websphere/management/MBeanFactory.html">{@code MBeanFactory}.
*
* @author Juergen Hoeller
* @author Rob Harrop
* @since 2.0.3
* @see javax.management.MBeanServer
* @see MBeanServerFactoryBean
*/

```

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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/remoting/support/RemoteInvocationFactory.java
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/opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/jmx/export/metadata/ManagedOperationParameter.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/remoting/support/RemoteInvocationExecutor.java
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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jar/org/springframework/ui/ModelMapExtensions.kt  
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- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/EmbeddedValueResolverAware.java
- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/jmx/export/notification/ModelMBeanNotificationPublisher.java
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- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/instrument/classloading/ReflectiveLoadTimeWeaver.java
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- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/remoting/rmi/RemoteInvocationSerializingExporter.java
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- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/remoting/rmi/JndiRmiServiceExporter.java
- \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/support/ContextTypeMatchClassLoader.java
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\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/MessageSourceAware.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/event/GenericApplicationListenerAdapter.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/expression/BeanFactoryResolver.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/support/LiveBeansView.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/scripting/bsh/BshScriptUtils.java  
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/opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/support/DefaultLifecycleProcessor.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/jmx/export/MBeanExporter.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/context/support/PropertySourcesPlaceholderConfigurer.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/scheduling/annotation/AsyncAnnotationAdvisor.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/validation/Validator.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/jmx/support/ObjectNameManager.java  
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/opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/cache/interceptor/CacheOperationExpressionEvaluator.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/format/datetime/standard/DateTimeFormatterFactory.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-jar/org/springframework/jndi/IndiObjectFactoryBean.java  
\* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

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jar/org/springframework/format/datetime/joda/JodaTimeContextHolder.java
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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/opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/scripting/config/ScriptBeanDefinitionParser.java
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/opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/cache/interceptor/NameMatchCacheOperationSource.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
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jar/org/springframework/instrument/classloading/websphere/WebSphereClassPreDefinePlugin.java
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 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
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 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
 jar/org/springframework/context/annotation/AdviceMode.java  
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 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
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 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
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 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
 jar/org/springframework/cache/config/CacheAdviceParser.java  
 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
 jar/org/springframework/cache/interceptor/AbstractFallbackCacheOperationSource.java  
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 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
 jar/org/springframework/scheduling/SchedulingTaskExecutor.java  
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 jar/org/springframework/scheduling/annotation/AsyncResult.java  
 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
 jar/org/springframework/validation/FieldError.java  
 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-  
 jar/org/springframework/context/support/FileSystemXmlApplicationContext.java  
 \* /opt/cola/permits/1651261842\_1682321498.7572014/0/spring-context-5-2-24-release-sources-

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jar/org/springframework/remoting/rmi/RmiServiceExporter.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/cache/interceptor/AbstractCacheResolver.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/remoting/support/RemoteInvocation.java
*
/opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/instrument/classloading/weblogic/WebLogicClassLoaderAdapter.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/ejb/access/SimpleRemoteStatelessSessionProxyFactoryBean.java
* /opt/cola/permits/1651261842_1682321498.7572014/0/spring-context-5-2-24-release-sources-
jar/org/springframework/cache/annotation/AbstractCachingConfiguration.java
```

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*/
/**
* Strategy interface for translating between { @link SQLException SQLExceptions }
* and Spring's data access strategy-agnostic { @link DataAccessException }
* hierarchy.
*
* <p>Implementations can be generic (for example, using
* { @link java.sql.SQLException#getSQLState() SQLState } codes for JDBC) or
* wholly
* proprietary (for example, using Oracle error codes) for greater precision.
*
* @author Rod Johnson
* @author Juergen Hoeller
* @see org.springframework.dao.DataAccessException
*/
```



Found in path(s):

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/SQLExceptionTranslator.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/incrementer/DB2MainframeSequenceMaxValueIncrementer.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/xml/SqlXmlValue.java

\*

/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/incrementer/DB2SequenceMaxValueIncrementer.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/DisposableSqlTypeValue.java

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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/SQLExceptionSubclassTranslator.java

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\*/

/\*\*

\* Implement this interface when parameters need to be customized based

\* on the connection. We might need to do this to make use of proprietary

\* features, available only with a specific Connection type.

\*

\* @author Rod Johnson

\* @author Thomas Risberg

\* @see CallableStatementCreatorFactory#newCallableStatementCreator(ParameterMapper)

\* @see org.springframework.jdbc.object.StoredProcedure#execute(ParameterMapper)

\*/

/\*\*

\* Create a Map of input parameters, keyed by name.

\* @param con a JDBC connection. This is useful (and the purpose of this interface)

\* if we need to do something RDBMS-specific with a proprietary Connection

\* implementation class. This class conceals such proprietary details. However,

\* it is best to avoid using such proprietary RDBMS features if possible.

\* @return a Map of input parameters, keyed by name (never { @code null })

\* @throws SQLException if an SQLException is encountered setting

\* parameter values (that is, there's no need to catch SQLException)

\*/

Found in path(s):

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/ParameterMapper.java

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```

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```
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/namedparam/MapSqlParameterSourceExtensions.kt
```

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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/RowMapperResultSetExtractor.java
```

```
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/incrementer/H2SequenceMaxValueIncrementer.java
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*
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/opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/object/SqlCall.java
```

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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/AbstractFallbackSQLExceptionTranslator.java
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
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jar/org/springframework/jdbc/datasource/AbstractDataSource.java  
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 jar/org/springframework/jdbc/LobRetrievalFailureException.java  
 \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
 jar/org/springframework/jdbc/core/namedparam/NamedParameterBatchUpdateUtils.java  
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 jar/org/springframework/jdbc/core/ResultSetSupportingSqlParameter.java  
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 jar/org/springframework/jdbc/datasource/UserCredentialsDataSourceAdapter.java  
 \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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 jar/org/springframework/jdbc/core/StatementCallback.java  
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 \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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 jar/org/springframework/jdbc/core/metadata/HanaCallMetaDataProvider.java  
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 jar/org/springframework/jdbc/support/CustomSQLExceptionTranslatorRegistrar.java  
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 jar/org/springframework/jdbc/support/incrementer/PostgresSequenceMaxValueIncrementer.java  
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 jar/org/springframework/jdbc/BadSqlGrammarException.java  
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 jar/org/springframework/jdbc/object/SqlQuery.java  
 \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
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 jar/org/springframework/jdbc/support/incrementer/HsqlSequenceMaxValueIncrementer.java

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/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/CannotGetJdbcConnectionException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/embedded/DerbyEmbeddedDatabaseConfigurer.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/UncategorizedSQLException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/GeneratedKeyHolder.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/InvalidResultSetAccessException.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/SqlInOutParameter.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/config/SortedResourcesFactoryBean.java

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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/DerbyCallMetaDataProvider.java

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jar/org/springframework/jdbc/core/ColumnMapRowMapper.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/core/BatchUpdateUtils.java  
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/RowCallbackHandler.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/init/DatabasePopulator.java
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/opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/lob/LobHandler.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/init/ScriptStatementFailedException.java
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/\*\*

\* Close this LobCreator session and free its temporarily created BLOBs and CLOBs.  
\* Will not need to do anything if using PreparedStatement's standard methods,  
\* but might be necessary to free database resources if using proprietary means.  
\* **NOTE**: Needs to be invoked after the involved

PreparedStatement have

\* been executed or the affected O/R mapping sessions have been flushed.  
\* Otherwise, the database resources for the temporary BLOBs might stay allocated.

\*/

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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/lob/LobCreator.java

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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/rowset/SqlRowSetMetaData.java  
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/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/UncategorizedScriptException.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/incrementer/HsqlMaxValueIncrementer.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/embedded/ConnectionProperties.java  
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* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/KeyHolder.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/SQLStateSQLExceptionTranslator.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/namedparam/AbstractSqlParameterSource.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/LazyConnectionDataSourceProxy.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
```

jar/org/springframework/jdbc/datasource/init/ResourceDatabasePopulator.java

\*

/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/core/support/AbstractLobStreamingResultSetExtractor.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/object/RdbmsOperation.java

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jar/org/springframework/jdbc/datasource/SmartDataSource.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/support/incrementer/AbstractSequenceMaxValueIncrementer.java

\*

/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/support/MetaDataAccessException.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/support/xml/XmlBinaryStreamProvider.java

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jar/org/springframework/jdbc/support/SqlValue.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/support/xml/XmlCharacterStreamProvider.java

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jar/org/springframework/jdbc/SQLWarningException.java

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jar/org/springframework/jdbc/core/InterruptibleBatchPreparedStatementSetter.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/support/xml/XmlResultProvider.java

\*

/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

jar/org/springframework/jdbc/datasource/embedded/SimpleDriverDataSourceFactory.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-

```
jar/org/springframework/jdbc/object/GenericStoredProcedure.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/lookup/SingleDataSourceLookup.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/support/xml/SqlXmlFeatureNotImplementedException.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/lookup/IndiDataSourceLookup.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/datasource/lookup/DataSourceLookupFailureException.java
*
/opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/core/BatchPreparedStatementSetter.java
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/config/JdbcNamespaceHandler.java
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```
/**
 * The classes in this package make JDBC easier to use and
 * reduce the likelihood of common errors. In particular, they:
 *
 * Simplify error handling, avoiding the need for try/catch/finally
 * blocks in application code.
 * Present exceptions to application code in a generic hierarchy of
 * unchecked exceptions, enabling applications to catch data access
 * exceptions without being dependent on JDBC, and to ignore fatal
 * exceptions there is no value in catching.
 * Allow the implementation of error handling to be modified
 * to target different RDBMSes without introducing proprietary
 * dependencies into application code.
 *
 *
 * <p>This package and related packages are discussed in Chapter 9 of
 * Expert One-On-One J2EE Design and
 * Development
 * by Rod Johnson (Wrox, 2002).
 */
```

```
Found in path(s):
* /opt/cola/permits/1651261891_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-
jar/org/springframework/jdbc/package-info.java
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/SqlProvider.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/CallParameterMetaData.java  
\*  
/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/DatabaseMetaDataCallback.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/JdbcUtils.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/CallMetaDataContext.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/embedded/AbstractEmbeddedDatabaseConfigurer.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/SimpleDriverDataSource.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/SingleConnectionDataSource.java  
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/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/embedded/DataSourceFactory.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/namedparam/SqlParameterSourceUtils.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/SQLErrorCodeSQLExceptionTranslator.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/SingleColumnRowMapper.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/namedparam/ParsedSql.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/PreparedStatementCreatorFactory.java  
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/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/SQLErrorCodesFactory.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/CallMetaDataProviderFactory.java

\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/DriverManagerDataSource.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/StatementCreatorUtils.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/JdbcTemplate.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/lookup/AbstractRoutingDataSource.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcTemplate.java  
\*  
/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/DatabasePopulatorUtils.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/DataSourceTransactionManager.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/simple/AbstractJdbcCall.java  
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\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/TableMetaDataProviderFactory.java  
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/opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcOperations.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/BeanPropertyRowMapper.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/GenericTableMetaDataProvider.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-



jar/org/springframework/jdbc/core/metadata/TableMetaDataContext.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/core/JdbcOperations.java  
\* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-  
jar/org/springframework/jdbc/core/namedparam/NamedParameterUtils.java  
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jar/org/springframework/jdbc/support/lob/AbstractLobHandler.java  
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jar/org/springframework/jdbc/core/support/AbstractLobCreatingPreparedStatementCallback.java  
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- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/DataSourceInitializer.java
- \*
- /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/simple/SimpleJdbcInsert.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/OracleCallMetaDataProvider.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/ConnectionProxy.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/PostgresCallMetaDataProvider.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/DelegatingDataSource.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptParseException.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/config/InitializeDatabaseBeanDefinitionParser.java
- \*
- /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/lob/PassThroughBlob.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/AbstractDriverBasedDataSource.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/support/SqLobValue.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/lob/PassThroughClob.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/ParameterDisposer.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/SqlServerCallMetaDataProvider.java
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- /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseFactoryBean.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/CustomSQLErrorCodesTranslation.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/support/xml/Jdbc4SqlXmlHandler.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/core/metadata/SybaseCallMetaDataProvider.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/datasource/lookup/BeanFactoryDataSourceLookup.java
- \* /opt/cola/permits/1651261891\_1682397191.3465927/0/spring-jdbc-5-2-24-release-sources-jar/org/springframework/jdbc/config/EmbeddedDatabaseBeanDefinitionParser.java

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jar/org/springframework/web/servlet/view/freemarker/FreeMarkerViewResolver.java
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```

```
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/NoHandlerFoundException.java
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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/document/AbstractXlsxView.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/document/AbstractXlsxStreamingView.java  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupConfig.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/ArgumentAware.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupViewResolver.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/VersionStrategy.java

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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/HtmlEscapingAwareTag.java

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 jar/org/springframework/web/servlet/view/tiles3/TilesView.java  
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 jar/org/springframework/web/servlet/config/annotation/RedirectViewControllerRegistration.java  
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 jar/org/springframework/web/servlet/mvc/method/annotation/AsyncTaskMethodReturnValueHandler.java  
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 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/HandlerExceptionResolverComposite.java

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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/ServerRequestExtensions.kt

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-

jar/org/springframework/web/servlet/mvc/method/annotation/ExceptionHandlerExceptionHandlerResolver.java  
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jar/org/springframework/web/servlet/function/HandlerFilterFunction.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/mvc/method/annotation/StreamingResponseBodyReturnValueHandler.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/view/script/ScriptTemplateConfigurer.java  
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/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
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jar/org/springframework/web/servlet/mvc/method/annotation/PathVariableMethodArgumentResolver.java  
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jar/org/springframework/web/servlet/resource/CachingResourceTransformer.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/MvcNamespaceHandler.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/Controller.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/InterceptorsBeanDefinitionParser.java

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/RequestCondition.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/AbstractTemplateView.java

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\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/AbstractHtmlElementTag.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/SimpleMappingExceptionHandlerResolver.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ServletResponseMethodArgumentResolver.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/BeanNameViewResolver.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/EscapeBodyTag.java  
\*  
/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/EvalTag.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/AbstractDataBoundFormElementTag.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/ResourceResolverChain.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/feed/AbstractAtomFeedView.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/LabelTag.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/ViewResolversBeanDefinitionParser.java  
\*  
/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/TilesConfigurerBeanDefinitionParser.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/GroovyMarkupConfigurerBeanDefinitionParser.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ResponseBodyAdvice.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/MatrixVariableMapMethodArgumentResolver.java

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jar/org/springframework/web/servlet/support/SessionFlashMapManager.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/AbstractMappingJacksonResponseBodyAdvice.java
*
/opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/FlashMapManager.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/tags/form/PasswordInputTag.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/config/annotation/UrlBasedViewResolverRegistration.java
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- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/form/ErrorsTag.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/DefaultServerResponseBuilder.java
- \*
- /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/ConsumesRequestCondition.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/tags/MessageTag.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/PathMatchConfigurer.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/ParamsRequestCondition.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/RequestMappingHandlerAdapter.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ResponseBodyEmitter.java
- \*
- /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/resource/ResourceHttpRequestHandler.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/support/AbstractFlashMapManager.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/RedirectView.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/RouterFunctionBuilder.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/handler/AbstractHandlerMapping.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/RequestMappingInfo.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/RequestPredicates.java
- \*
- /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/function/DefaultServerRequestBuilder.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/ResourceHandlerRegistry.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/condition/HeadersRequestCondition.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/AbstractTemplateViewResolver.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/config/annotation/ContentNegotiationConfigurer.java
- \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/SseEmitter.java
- \*

/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/method/annotation/AbstractMessageConverterMethodProcessor.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/function/DefaultEntityResponseBuilder.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/function/RouterFunctions.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurationSupport.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/config/annotation/ViewControllerRegistry.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/function/DefaultServerRequest.java  
 \*  
 /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/condition/ProducesRequestCondition.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/condition/PatternsRequestCondition.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/HandlerExecutionChain.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/resource/AppCacheManifestTransformer.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/method/annotation/ServletCookieValueMethodArgumentResolver.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/UrlFilenameViewController.java  
 \*  
 /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/config/ResourcesBeanDefinitionParser.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/condition/RequestMethodRequestCondition.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/function/ServerRequest.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/config/annotation/CorsRegistry.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/i18n/CookieLocaleResolver.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/tags/UrlTag.java  
 \*  
 /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/method/annotation/HttpEntityMethodProcessor.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/config/annotation/CorsRegistration.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/annotation/ResponseStatusExceptionHandlerResolver.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
 jar/org/springframework/web/servlet/mvc/method/annotation/ResponseBodyEmitterReturnValueHandler.java  
 \* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-

jar/org/springframework/web/servlet/mvc/condition/AbstractMediaTypeExpression.java  
\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/support/ServletUriComponentsBuilder.java  
\*  
/opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-  
jar/org/springframework/web/servlet/config/AnnotationDrivenBeanDefinitionParser.java  
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jar/org/springframework/web/servlet/theme/AbstractThemeResolver.java  
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/\*\*  
\* A contract for inspecting and potentially modifying request data values such  
\* as URL query parameters or form field values before they are rendered by a  
\* view or before a redirect.

```
*
* <p>Implementations may use this contract for example as part of a solution
* to provide data integrity, confidentiality,
* protection against cross-site
* request forgery (CSRF), and others or for other tasks such as automatically
* adding a hidden field to all forms and URLs.
*
* <p>View technologies that support this contract can obtain an instance to
* delegate to via { @link RequestContext#getRequestDataValueProcessor()}.
*
* @author Rossen Stoyanchev
* @since 3.1
*/
```

Found in path(s):

```
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/support/RequestDataValueProcessor.java
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```
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jar/org/springframework/web/servlet/mvc/HttpRequestHandlerAdapter.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/condition/MediaTypeExpression.java
*
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/SmartView.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/tags/form/OptionWriter.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/handler/AbstractDetectingUrlHandlerMapping.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
```

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jar/org/springframework/web/servlet/tags/form/TagIdGenerator.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/view/tiles3/AbstractSpringPreparerFactory.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/tags/form/RadioButtonsTag.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/handler/SimpleServletHandlerAdapter.java
*
/opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/tags/ParamAware.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/AbstractUrlViewController.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/support/RedirectAttributes.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/LastModified.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/handler/ConversionServiceExposingInterceptor.java
* /opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/mvc/SimpleControllerHandlerAdapter.java
*
/opt/cola/permits/1651261818_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-
jar/org/springframework/web/servlet/view/tiles3/SpringBeanPreparerFactory.java
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```
*/
```

```
/**
```

```
* XSLT-driven View that allows for response context to be rendered as the
```

```
* result of an XSLT transformation.
```

```
*
```

```
* <p>The XSLT Source object is supplied as a parameter in the model and then
```

```
* { @link #locateSource detected } during response rendering. Users can either specify
```

```
* a specific entry in the
```



model via the { @link #setSourceKey sourceKey } property or

- \* have Spring locate the Source object. This class also provides basic conversion
- \* of objects into Source implementations. See { @link #getSourceTypes() here }
- \* for more details.
- \*
- \* <p>All model parameters are passed to the XSLT Transformer as parameters.
- \* In addition the user can configure { @link #setOutputProperties output properties }
- \* to be passed to the Transformer.
- \*
- \* @author Rob Harrop
- \* @author Juergen Hoeller
- \* @since 2.0
- \*/

Found in path(s):

\* /opt/cola/permits/1651261818\_1682397183.052122/0/spring-webmvc-5-2-24-release-sources-jar/org/springframework/web/servlet/view/xslt/XsltView.java

# 1.355 spring-tx 5.2.24.RELEASE

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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/jca/cci/core/RecordCreator.java

\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/dao/support/PersistenceExceptionTranslator.java

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jar/org/springframework/transaction/TransactionException.java

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jar/org/springframework/transaction/event/TransactionalEventListener.java

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/opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/reactive/TransactionalOperator.java  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/transaction/annotation/EnableTransactionManagement.java  
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\* /opt/cola/permits/1651261844\_1682321444.8156874/0/spring-tx-5-2-24-release-sources-jar/org/springframework/jca/cci/connection/CciLocalTransactionManager.java  
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* /opt/cola/permits/1651261844_1682321444.8156874/0/spring-tx-5-2-24-release-sources-
jar/org/springframework/transaction/jta/WebLogicJtaTransactionManager.java
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\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/BeanIsNotAFactoryException.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/PropertyEditorRegistrar.java  
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\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/xml/SimplePropertyNamespaceHandler.java  
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/opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/BeansException.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/support/BeanDefinitionReader.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/RuntimeBeanNameReference.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/ListFactoryBean.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/SetFactoryBean.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/support/MethodOverride.java  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/BeanDefinitionHolder.java  
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/opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/ListableBeanFactoryExtensions.kt  
\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/BeanMetadataAttributeAccessor.java  
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\* /opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-

jar/org/springframework/beans/factory/config/ServiceLocatorFactoryBean.java

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jar/org/springframework/beans/factory/support/NullBean.java

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jar/org/springframework/beans/propertyeditors/ByteArrayPropertyEditor.java

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jar/org/springframework/beans/factory/xml/AbstractSimpleBeanDefinitionParser.java

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jar/org/springframework/beans/factory/annotation/AnnotatedBeanDefinition.java

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/opt/cola/permits/1651261834\_1682321546.5973234/0/spring-beans-5-2-24-release-sources-

jar/org/springframework/beans/factory/SmartInitializingSingleton.java

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jar/org/springframework/beans/NotReadablePropertyException.java

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jar/org/springframework/aop/framework/autoproxy/AbstractAdvisorAutoProxyCreator.java  
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jar/org/springframework/aop/aspectj/MethodInvocationProceedingJoinPoint.java  
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jar/org/springframework/aop/aspectj/autoproxy/AspectJAwareAdvisorAutoProxyCreator.java  
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- \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/aspectj/SingletonAspectInstanceFactory.java
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jar/org/springframework/aop/framework/autoproxy/AbstractAutoProxyCreator.java
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jar/org/springframework/aop/framework/DefaultAopProxyFactory.java
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jar/org/springframework/aop/DynamicIntroductionAdvice.java
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jar/org/springframework/aop/framework/AdvisedSupportListener.java
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jar/org/springframework/aop/IntroductionInterceptor.java
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jar/org/springframework/aop/RawTargetAccess.java
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jar/org/springframework/aop/BeforeAdvice.java
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jar/org/springframework/aop/framework/InterceptorAndDynamicMethodMatcher.java
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jar/org/springframework/aop/framework/AopInfrastructureBean.java
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jar/org/springframework/aop/TrueClassFilter.java
* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
jar/org/springframework/aop/target/HotSwappableTargetSource.java
* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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jar/org/springframework/aop/framework/AbstractAdvisingBeanPostProcessor.java
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
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jar/org/springframework/aop/target/AbstractPoolingTargetSource.java
* /opt/cola/permits/1651261858_1682321586.8808553/0/spring-aop-5-2-24-release-sources-
jar/org/springframework/aop/config/ConfigBeanDefinitionParser.java
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jar/org/springframework/aop/framework/autoproxy/ProxyCreationContext.java
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\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/scope/DefaultScopedObject.java  
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/opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-jar/org/springframework/aop/target/ThreadLocalTargetSourceStats.java

\* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/target/dynamic/Refreshable.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/config/ScopedProxyBeanDefinitionDecorator.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/target/SimpleBeanTargetSource.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/AfterReturningAdvice.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/framework/adaptor/AdvisorAdapter.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/support/StaticMethodMatcherPointcut.java  
 \*  
 /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/IntroductionInfo.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/interceptor/ConcurrencyThrottleInterceptor.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/support/DynamicMethodMatcherPointcut.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/framework/adaptor/ThrowsAdviceAdapter.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/config/SpringConfiguredBeanDefinitionParser.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/framework/adaptor/UnknownAdviceTypeException.java  
 \*  
 /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/framework/adaptor/AdvisorAdapterRegistrationManager.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/interceptor/DebugInterceptor.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/target/LazyInitTargetSource.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/config/PointcutComponentDefinition.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/PointcutAdvisor.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/target/dynamic/BeanFactoryRefreshableTargetSource.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/framework/AopProxy.java  
 \*  
 /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/support/JdkRegexpMethodPointcut.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/IntroductionAdvisor.java  
 \* /opt/cola/permits/1651261858\_1682321586.8808553/0/spring-aop-5-2-24-release-sources-  
 jar/org/springframework/aop/scope/ScopedObject.java

# 1.358 berkeley-db 4.4.20

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 * $Id: LICENSE,v 12.1 2005/06/16 20:20:10 bostic Exp $
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 \*  
 \* \$Id: db\_hotbackup.c,v 1.16 2005/10/27 01:25:54 mjc Exp \$  
 \*/

## 1.359 libgpg-error 1.37-1

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# 1.361 systemd 245.4-4ubuntu3.22

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```

/*****
* NCSA HTTPd Server
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* National Center for Supercomputing Applications
* University of Illinois at Urbana-Champaign
* 605 E. Springfield, Champaign, IL 61820
* httpd@ncsa.uiuc.edu
*
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*
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Written by Adam Twiss (adam@zeus.co.uk). March 1996

Thanks to the following people for their input:

Mike Belshe (mbelshe@netscape.com)

Michael Campanella (campanella@stevms.enet.dec.com)

```
*/
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" lang="en" xml:lang="en"><head>
<meta content="text/html; charset=UTF-8" http-equiv="Content-Type" />
<!--
XX
X
 This file is generated from xml source: DO NOT EDIT
XX
X
 -->
<title>The Apache License, Version 2.0 - Apache HTTP Server Version 2.4</title>
<link href="/style/css/manual.css" rel="stylesheet" media="all" type="text/css" title="Main stylesheet" />
<link href="/style/css/manual-loose-100pc.css" rel="alternate stylesheet" media="all" type="text/css" title="No
Sidebar - Default font size" />
<link href="/style/css/manual-print.css" rel="stylesheet" media="print" type="text/css" /><link rel="stylesheet"
type="text/css" href="/style/css/prettify.css"
/>
<script src="/style/scripts/prettify.min.js" type="text/javascript">
</script>

<link href="/images/favicon.ico" rel="shortcut icon" /></head>
<body id="manual-page" class="no-sidebar"><div id="page-header">
<p class="menu">Modules | Directives | FAQ | Glossary | Sitemap</p>
<p class="apache">Apache HTTP Server Version 2.4</p>
</div>
```

<div class="up"><a href="."/></a></div>  
<div id="path">  
<a href="http://www.apache.org/">Apache</a> &gt; <a href="http://httpd.apache.org/">HTTP Server</a> &gt; <a href="http://httpd.apache.org/docs/">Documentation</a> &gt; <a href="."/>Version 2.4</a></div><div id="page-content"><div id="preamble"><h1>The Apache License, Version 2.0</h1>  
<div class="toplant">  
<p><span>Available  
Languages: </span><a href="/en/license.html" title="English">&nbsp;en&nbsp;</a></p>  
</div>

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```
<!--><![CDATA[<!--
```

```
var comments_shortname = 'httpd';
```

```
var comments_identifier = 'http://httpd.apache.org/docs/2.4/license.html';
```

```

(function(w, d) {
 if (w.location.hostname.toLowerCase() == "httpd.apache.org") {
 d.write('<div id="comments_thread"></div>');
 var s = d.createElement('script');
 s.type = 'text/javascript';
 s.async = true;
 s.src = 'https://comments.apache.org/show_comments.lua?site=' + comments_shortname + '&page=' +
comments_identifier;
 (d.getElementsByTagName('head')[0] || d.getElementsByTagName('body')[0]).appendChild(s);
 }
 else {
 d.write('<div id="comments_thread">Comments are disabled for this page at the moment.</div>');
 }
})(window, document);
<!--><![></script></div><div id="footer">
<p class="apache">Copyright 2023 The Apache Software Foundation.
Licensed under the Apache License, Version 2.0.</p>
<p class="menu">Modules | Directives | FAQ | Glossary | Sitemap</p></div><script type="text/javascript"><!--><![CDATA[<!--><!-->
if (typeof(prettyPrint) !== 'undefined') {
 prettyPrint();
}
<!--><![></script>
</body></html>

```

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# 1.363 openssl 1.1.1u

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```
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## 1.364 perl 5.34.0-3ubuntu1.2

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# 1.365 libssh 0.9.3-2ubuntu2.3

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Any executables

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## 1.366 flyway-spring5-test 6.4.0

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\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/context/dataSourceSingleContext.xml

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/context/flywayPropertiesContext.xml

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/context/secondFlywayContainerContext.xml

\*

/opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/context/simple\_applicationContext.xml

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/context/flywaySingleContext.xml

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Found in path(s):

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/FlywayTestExecutionListener.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/ExecutionListenerHelper.java

\*

/opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit/FlywayTestExecutionListener.java

\* /opt/cola/permits/1705980508\_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-jar/org/flywaydb/test/junit5/annotation/FlywayTestExtension.java

```
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/org/flywaydb/test/FlywayHelperFactory.java
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/org/flywaydb/test/junit5/annotation/package-info.java
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/org/flywaydb/test/junit/package-info.java
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/org/flywaydb/test/junit5/FlywayTestExtension.java
* /opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/org/flywaydb/test/junit/FlywayHelperFactory.java
*
/opt/cola/permits/1705980508_1686041451.9314718/0/flyway-spring5-test-6-4-0-sources-1-
jar/org/flywaydb/test/package-info.java
```

## 1.367 flyway-test 6.4.0

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```
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jar/org/flywaydb/test/annotation/FlywayTests.java
* /opt/cola/permits/1705980500_1686096448.7662416/0/flyway-test-6-4-0-sources-1-
jar/org/flywaydb/test/annotation/package-info.java
* /opt/cola/permits/1705980500_1686096448.7662416/0/flyway-test-6-4-0-sources-1-
jar/org/flywaydb/test/annotation/FlywayTest.java
```

## 1.368 linux-kernel 5.10.145

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```

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```
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```

The hypothetical commands

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/\* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)

\* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)

\*

\* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

\* <http://www.hypermall.com/>

\* 10/1/97 - commented out CFG\_PHYIE bit - we don't care when the PHY

\* interrupts us (except possibly for removal/insertion of the cable?)

\* 10/4/97 - began heavy inline documentation of the code. Corrected typos

\* and spelling mistakes.

\* 10/5/97 - added code to handle PHY interrupts, disable PHY on

\* loss of link, and correctly re-enable PHY when link is

\* re-established. (put back CFG\_PHYIE)

\*

\* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.

\*

\* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997

\*

\* Linux driver for the IDT77201 NICStAR PCI ATM controller.

\* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;

\* see init\_nicstar() for PHY initialization to change this. This driver

\* expects the Linux ATM stack to support scatter-gather

lists

\* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.

\*

\* Implementing minimal-copy of received data:

\* IDT always receives data into a small buffer, then large buffers

\* as needed. This means that data must always be copied to create

\* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)

\* Fix is simple: make large buffers large enough to hold entire

\* SDU, and leave <small\_buffer\_data> bytes empty at the start. Then

\* copy small buffer contents to head of large buffer.

\* Trick is to avoid fragmenting Linux, due to need for a lot of large

\* buffers. This is done by 2 things:

\* 1) skb->destructor / skb->atm.recycle\_buffer

\* combined, allow nicstar\_free\_rx\_skb to be called to

\* recycle large data buffers

```

* 2) skb_clone of received buffers
* See nicstar_free_rx_skb and linearize_buffer for implementation
* details.
*
*
*
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* Foundation, Inc., 675 Mass Ave, Cambridge, MA 02139, USA.
*
* M. Welsh, 6 July 1996
*
*
*/

```

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set yrange [0:]

set terminal pngcairo font 'Sans, 8' lw 1 size 1400,1024

set xtics rotate by -45

set style histogram errorbars gap 2 lw 1

set style fill solid border -1

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## 1.371 python 3.9.17

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands

as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

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Release	Derived from	Year	Owner	GPL-compatible? (1)
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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now	PSF	yes

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# 1.376 spring-framework 5.2.24.RELEASE

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/**
 * A Base64 encoder/decoder.
 *
 * <p>
 * This class is used to encode and decode data in Base64 format as described in RFC 1521.
 *
 * <p>
 * Project home page: www.
 * source-code.biz/base64coder/java

 * Author: Christian d'Heureuse, Inventec Informatik AG, Zurich, Switzerland

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 */
```

Found in path(s):

```
* /opt/cola/permits/1720484947_1686744817.7895513/0/snakeyaml-2-0-sources-6-
jar/org/yaml/snakeyaml/external/biz/base64Coder/Base64Coder.java
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\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/introspector/PropertyUtils.java  
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/opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/resolver/Resolver.java  
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/opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/nodes/ScalarNode.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/scanner/ScannerImpl.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/tokens/TagTuple.java  
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/opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/extensions/compactnotation/CompactData.java  
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\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/env/EnvScalarConstructor.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/introspector/FieldProperty.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/introspector/Property.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/tokens/DirectiveToken.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/error/MissingEnvironmentVariableException.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/introspector/BeanAccess.java  
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\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/serializer/SerializerException.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/tokens/FlowMappingEndToken.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/tokens/BlockSequenceStartToken.java  
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jar/org/yaml/snakeyaml/LoaderOptions.java  
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jar/org/yaml/snakeyaml/serializer/NumberAnchorGenerator.java  
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jar/org/yaml/snakeyaml/serializer/AnchorGenerator.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/constructor/DuplicateKeyException.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/events/CollectionStartEvent.java

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/opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/tokens/TagToken.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/tokens/ScalarToken.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/parser/VersionTagsTuple.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/events/ImplicitTuple.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/tokens/FlowMappingStartToken.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/events/MappingStartEvent.java

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\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/util/UriEncoder.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/representer/Represent.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/error/Mark.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/nodes/SequenceNode.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/inspector/UnTrustedTagInspector.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/introspector/PropertySubstitute.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/constructor/BaseConstructor.java

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/opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/scanner/SimpleKey.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/constructor/Construct.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/emitter/EmitterState.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-jar/org/yaml/snakeyaml/reader/UnicodeReader.java

\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-



jar/org/yaml/snakeyaml/events/StreamEndEvent.java  
\* /opt/cola/permits/1720484947\_1686744817.7895513/0/snakeyaml-2-0-sources-6-  
jar/org/yaml/snakeyaml/parser/Parser.java

# 1.378 libnss-nisplus 2.31

## 1.378.1 Available under license :

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Version 2.1, February 1999

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### xwd utility

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# 1.385 Ivm2 1.02.132

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## 1.387 spring-security-config 5.4.11

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## 1.390 pymongo 4.4.1

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## 1.391 pyjwt 2.8.0

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From strings/apr\_strnatcmp.c,  
include/apr\_strings.h:

strnatcmp.c -- Perform 'natural order' comparisons of strings in C.  
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From  
strings/apr\_snprintf.c:

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package engine

```
import (
 "time"

 "github.com/docker/cli/cli/command/formatter"
 "github.com/docker/cli/internal/licenseutils"
 "github.com/docker/licensing/model"
)

const (
 defaultSubscriptionsTableFormat = "table
{{.Num}}\t{{.Owner}}\t{{.ProductID}}\t{{.Expires}}\t{{.ComponentsString}}"
 defaultSubscriptionsQuietFormat = "{{.Num}}:{{.Summary}}"

 numHeader = "NUM"
 ownerHeader = "OWNER"
 licenseNameHeader = "NAME"
 idHeader = "ID"
 dockerIDHeader = "DOCKER ID"
 productIDHeader = "PRODUCT ID"
 productRatePlanHeader = "PRODUCT RATE PLAN"
 productRatePlanIDHeader = "PRODUCT RATE PLAN ID"
 startHeader = "START"
 expiresHeader = "EXPIRES"
 stateHeader = "STATE"
 eusaHeader = "EUSA"
 pricingComponentsHeader = "PRICING COMPONENTS"
)

// NewSubscriptionsFormat returns a Format for rendering using a license Context
```

```

func NewSubscriptionsFormat(source string, quiet bool) formatter.Format
{
switch source {
case formatter.TableFormatKey:
if quiet {
return defaultSubscriptionsQuietFormat
}
return defaultSubscriptionsTableFormat
case formatter.RawFormatKey:
if quiet {
return `license: {{.ID}}`
}
return `license: {{.ID}}\nname: {{.Name}}\nowner: {{.Owner}}\ncomponents: {{.ComponentsString}}\n`
}
return formatter.Format(source)
}

// SubscriptionsWrite writes the context
func SubscriptionsWrite(ctx formatter.Context, subs []licenseutils.LicenseDisplay) error {
render := func(format func(subContext formatter.SubContext) error) error {
for _, sub := range subs {
licenseCtx := &licenseContext{trunc: ctx.Trunc, l: sub}
if err := format(licenseCtx); err != nil {
return err
}
}
return nil
}
licenseCtx := licenseContext{ }
licenseCtx.Header = map[string]string{
"Num": numHeader,
"Owner": ownerHeader,
"Name": licenseNameHeader,
"ID": idHeader,
"DockerID": dockerIDHeader,
"ProductID":
productIDHeader,
"ProductRatePlan": productRatePlanHeader,
"ProductRatePlanID": productRatePlanIDHeader,
"Start": startHeader,
"Expires": expiresHeader,
"State": stateHeader,
"Eusa": eusaHeader,
"ComponentsString": pricingComponentsHeader,
}
return ctx.Write(&licenseCtx, render)
}

```

```

type licenseContext struct {
 formatter.HeaderContext
 trunc bool
 l licenseutils.LicenseDisplay
}

func (c *licenseContext) MarshalJSON() ([]byte, error) {
 return formatter.MarshalJSON(c)
}

func (c *licenseContext) Num() int {
 return c.l.Num
}

func (c *licenseContext) Owner() string {
 return c.l.Owner
}

func (c *licenseContext) ComponentsString() string {
 return c.l.ComponentsString
}

func (c *licenseContext) Summary() string {
 return c.l.String()
}

func (c *licenseContext) Name() string {
 return c.l.Name
}

func (c *licenseContext) ID() string {
 return c.l.ID
}

func (c *licenseContext) DockerID()
string {
 return c.l.DockerID
}

func (c *licenseContext) ProductID() string {
 return c.l.ProductID
}

func (c *licenseContext) ProductRatePlan() string {
 return c.l.ProductRatePlan
}

func (c *licenseContext) ProductRatePlanID() string {

```



```

return c.l.ProductRatePlanID
}

func (c *licenseContext) Start() *time.Time {
return c.l.Start
}

func (c *licenseContext) Expires() *time.Time {
return c.l.Expires
}

func (c *licenseContext) State() string {
return c.l.State
}

func (c *licenseContext) Eusa() *model.EusaState {
return c.l.Eusa
}

func (c *licenseContext) PricingComponents() []model.SubscriptionPricingComponent {
// Dereference the pricing component pointers in the pricing components
// so it can be rendered properly with the template formatter

var ret []model.SubscriptionPricingComponent
for _, spc := range c.l.PricingComponents {
if spc == nil {
continue
}
ret = append(ret, *spc)
}
return ret
}

```

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package engine

```
import (
 "bytes"
 "encoding/json"
 "strings"
 "testing"
 "time"

 "github.com/docker/cli/cli/command/formatter"
 "github.com/docker/cli/internal/licenseutils"
 "github.com/docker/licensing/model"
```

```

"gotest.tools/v3/assert"
is "gotest.tools/v3/assert/cmp"
)

func TestSubscriptionContextWrite(t *testing.T) {
cases := []struct {
context formatter.Context
expected string
}{
// Errors
{
formatter.Context{Format: "{{InvalidFunction}}"},
`Template parsing error: template: :1: function "InvalidFunction" not defined
`,
},
{
formatter.Context{Format: "{{nil}}"},
`Template parsing error: template: :1:2: executing "" at <nil>: nil is not a command
`,
},
// Table format
{
formatter.Context{Format: NewSubscriptionsFormat("table", false)},
`NUM OWNER PRODUCT ID EXPIRES PRICING COMPONENTS
1 owner1 productid1 2020-01-01 10:00:00 +0000 UTC compstring
2
 owner2 productid2 2020-01-01 10:00:00 +0000 UTC compstring
`,
},
{
formatter.Context{Format: NewSubscriptionsFormat("table", true)},
`1:License Name: name1 Quantity: 10 nodes Expiration date: 2020-01-01
2:License Name: name2 Quantity: 20 nodes Expiration date: 2020-01-01
`,
},
{
formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", false)},
`OWNER
owner1
owner2
`,
},
{
formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", true)},
`OWNER
owner1
owner2
`,
}
}
}

```

```

 },
 // Raw Format
 {
 formatter.Context{Format: NewSubscriptionsFormat("raw", false)},
 `license: id1
name: name1
owner: owner1
components: compstring

license: id2
name: name2
owner: owner2
components: compstring

 },
 },
 {
 formatter.Context{Format: NewSubscriptionsFormat("raw", true)},
 `license: id1
license: id2
 },
 },
 // Custom Format
 {
 formatter.Context{Format: NewSubscriptionsFormat("{{.Owner}}", false)},
 `owner1
owner2
 },
 },
}

```

```

expiration,
_ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")

```

```

for _, testcase := range cases {
subscriptions := []licenseutils.LicenseDisplay{
{
Num: 1,
Owner: "owner1",
Subscription: model.Subscription{
ID: "id1",
Name: "name1",
ProductID: "productid1",
Expires: &expiration,
PricingComponents: model.PricingComponents{
&model.SubscriptionPricingComponent{
Name: "nodes",
Value: 10,

```

```

 },
 },
 },
 ComponentsString: "compstring",
 },
 {
 Num: 2,
 Owner: "owner2",
 Subscription: model.Subscription{
 ID: "id2",
 Name: "name2",
 ProductID: "productid2",
 Expires: &expiration,
 PricingComponents: model.PricingComponents{
 &model.SubscriptionPricingComponent{
 Name: "nodes",
 Value: 20,
 },
 },
 },
 ComponentsString: "compstring",
 },
 }
 out := &bytes.Buffer{}
 testcase.context.Output
 = out
 err := SubscriptionsWrite(testcase.context, subscriptions)
 if err != nil {
 assert.Error(t, err, testcase.expected)
 } else {
 assert.Check(t, is.Equal(testcase.expected, out.String()))
 }
 }
 }

func TestSubscriptionContextWriteJSON(t *testing.T) {
 expiration, _ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")
 subscriptions := []licenseutils.LicenseDisplay{
 {
 Num: 1,
 Owner: "owner1",
 Subscription: model.Subscription{
 ID: "id1",
 Name: "name1",
 ProductID: "productid1",
 Expires: &expiration,
 PricingComponents: model.PricingComponents{
 &model.SubscriptionPricingComponent{

```

```

 Name: "nodes",
 Value: 10,
 },
},
ComponentsString: "compstring",
},
{
 Num: 2,
 Owner: "owner2",
 Subscription: model.Subscription{
 ID: "id2",
 Name: "name2",
 ProductID: "productid2",
 Expires: &expiration,
 PricingComponents: model.PricingComponents{
 &model.SubscriptionPricingComponent{
 Name:
"nodes",
 Value: 20,
 },
 },
 ComponentsString: "compstring",
 },
}
expectedJSONs := []map[string]interface{}{
{
 "Owner": "owner1",
 "ComponentsString": "compstring",
 "Expires": "2020-01-01T10:00:00Z",
 "DockerID": "",
 "Eusa": nil,
 "ID": "id1",
 "Start": nil,
 "Name": "name1",
 "Num": float64(1),
 "PricingComponents": []interface{}{
 map[string]interface{}{
 "name": "nodes",
 "value": float64(10),
 },
 },
 "ProductID": "productid1",
 "ProductRatePlan": "",
 "ProductRatePlanID": "",
 "State": "",
 "Summary": "License Name: name1\tQuantity: 10 nodes\tExpiration date: 2020-01-01",
}
}

```



```

},
{
 "Owner": "owner2",
 "ComponentsString": "compstring",
 "Expires": "2020-01-01T10:00:00Z",
 "DockerID": "",
 "Eusa": nil,
 "ID": "id2",
 "Start": nil,
 "Name": "name2",
 "Num": float64(2),
 "PricingComponents": []interface{}{
 map[string]interface{}{
 "name": "nodes",
 "value": float64(20),
 },
 },
 "ProductID": "productid2",
 "ProductRatePlan": "",
 "ProductRatePlanID": "",
 "State": "",
 "Summary": "License Name: name2\tQuantity: 20 nodes\tExpiration date: 2020-01-01",
},
}

```

```

out := &bytes.Buffer{ }
err := SubscriptionsWrite(formatter.Context{Format: "{{json .}}", Output: out}, subscriptions)
if err != nil {
 t.Fatal(err)
}
for i, line := range strings.Split(strings.TrimSpace(out.String()), "\n") {
 var m map[string]interface{}
 if err := json.Unmarshal([]byte(line), &m); err != nil {
 t.Fatal(err)
 }
 assert.Check(t, is.DeepEqual(expectedJSONs[i], m))
}
}

func TestSubscriptionContextWriteJSONField(t *testing.T) {
 subscriptions := []licenseutils.LicenseDisplay{
 {Num: 1,
 Owner: "owner1"},
 {Num: 2, Owner: "owner2"},
 }
 out := &bytes.Buffer{ }
 err := SubscriptionsWrite(formatter.Context{Format: "{{json .Owner}}", Output: out}, subscriptions)

```

```
if err != nil {
 t.Fatal(err)
}
for i, line := range strings.Split(strings.TrimSpace(out.String()), "\n") {
 var s string
 if err := json.Unmarshal([]byte(line), &s); err != nil {
 t.Fatal(err)
 }
 assert.Check(t, is.Equal(subscriptions[i].Owner, s))
}
}
```

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package licensing

```
import (
 "context"
 "crypto/hmac"
 "crypto/sha256"
 "encoding/base64"
 "encoding/json"
 "fmt"
 "time"

 "github.com/docker/libtrust"
 "github.com/docker/licensing/lib/errors"
 "github.com/docker/licensing/lib/go-clientlib"
 "github.com/docker/licensing/model"
)
```



```

func (c *client) getLicenseFile(ctx context.Context, subID string) (*model.IssuedLicense, error) {
 url := c.baseURI
 url.Path += fmt.Sprintf("/api/billing/v4/subscriptions/%s/license-file", subID)

 license := new(model.IssuedLicense)
 if _, _, err := c.doReq(ctx, "GET", &url, clientlib.RecvJSON(license)); err != nil {
 return nil, err
 }

 return license, nil
}

// Check verifies that the license identified by the given key id is valid. Note that it does not
// interrogate the contents of the license.
func (c *client) check(ctx context.Context, license model.IssuedLicense) (*model.CheckResponse, error) {
 keyID := license.KeyID
 privateKey := license.PrivateKey

 authorization, err := c.getAuthorization(ctx,
 license)
 if err != nil {
 return nil, err
 }

 // TODO: Mason - replace this parseJWS with a non libtrust lib
 signature, err := libtrust.ParseJWS(authorization)
 if err != nil {
 return nil, errors.Wrapf(err, errors.Fields{
 "key_id": keyID,
 }, "license parse JWS failed")
 }

 keys, err := signature.Verify()
 if err != nil {
 return nil, errors.Wrapf(err, errors.Fields{
 "key_id": keyID,
 }, "license signature verification failed")
 }

 keyCnt := len(keys)
 if keyCnt != 1 {
 err = fmt.Errorf("unexpected number of signing keys (%d)", keyCnt)
 return nil, errors.WithStack(err).With(errors.Fields{
 "key_id": keyID,
 })
 }
}

```

```

key := keys[0]

if !c.recognizedSigningKey(key) {
 return nil, errors.New("unrecognized signing key")
}

payload, err := signature.Payload()
if err != nil {
 return nil, errors.Wrapf(err, errors.Fields{
 "key_id": keyID,
 }, "malformed signature payload")
}

checkRes := new(model.CheckResponse)

err = json.Unmarshal(payload, &checkRes)
if
err != nil {
 return nil, errors.Wrapf(err, errors.Fields{
 "key_id": keyID,
 }, "license payload unmarshal failed")
}

msg := checkRes.Expiration.Format(time.RFC3339)
if err := checkToken(msg, checkRes.Token, privateKey); err != nil {
 return nil, errors.Wrapf(err, errors.Fields{
 "key_id": keyID,
 })
}

return checkRes, nil
}

// recognizedSigningKey returns true if the given key is signed with a recognized signing key, false otherwise
func (c *client) recognizedSigningKey(key libtrust.PublicKey) bool {
 for _, publicKey := range c.publicKeys {
 if key.KeyID() == publicKey.KeyID() {
 return true
 }
 }
 return false
}

// getAuthorization returns the decoded license authorization
func (c *client) getAuthorization(ctx context.Context, license model.IssuedLicense) ([]byte, error) {
 decoded, err := base64.StdEncoding.DecodeString(license.Authorization)
 if err != nil {
 return nil, errors.Wrapf(err, errors.Fields{

```

```

 "key_id": license.KeyID,
 }, "decoding license authorization
failed")
}
return decoded, nil
}

// All of the functions in this file assume that they are receiving a properly
// formatted private key.

// checkToken performs a MAC algorithm (where token is generated by hashing the
// message with the privateKey via GenerateToken) with the purpose of authenticating
// the validity of both the message and the private key of the person who generated
// the token.
func checkToken(message, token, privateKey string) error {
 tokenBytes, err := base64.URLEncoding.DecodeString(token)
 if err != nil {
 return errors.Wrap(err, errors.Fields{"token": token})
 }

 generatedToken, err := generateToken(message, privateKey)
 if err != nil {
 return errors.Wrap(err, errors.Fields{"token": token})
 }

 generatedBytes, err := base64.URLEncoding.DecodeString(generatedToken)
 if err != nil {
 return errors.Wrap(err, errors.Fields{"token": token})
 }

 if !hmac.Equal(tokenBytes, generatedBytes) {
 return errors.Forbidden(errors.Fields{"token": token},
"invalid token")
 }

 return nil
}

// generateToken generates a hash of the message with the privateKey via the
// sha256 algorithm.
func generateToken(message, privateKey string) (string, error) {
 key, err := base64.URLEncoding.DecodeString(privateKey)
 if err != nil {
 return "", errors.Wrap(err, errors.Fields{"msg": message})
 }

 h := hmac.New(sha256.New, key)
 h.Write([]byte(message))

```

```
return base64.URLEncoding.EncodeToString(h.Sum(nil)), nil
}
```

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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package model

```
import "time"
```

```
// A CheckResponse is the internal content of the PublicCheckResponse signed
```

```
// json blob.
```

```
type CheckResponse struct {
 Expiration time.Time `json:"expiration"`
 Token string `json:"token"`
 MaxEngines int `json:"maxEngines"`
 ScanningEnabled bool `json:"scanningEnabled"`
 Type string `json:"licenseType"`
 Tier string `json:"tier"`
}
```

```
// IssuedLicense represents an issued license
```

```
type IssuedLicense struct {
 KeyID string `json:"key_id"`
 PrivateKey string `json:"private_key"`
}
```

```

Authorization string `json:"authorization"`
}

// Valid returns true if the License is syntactically valid, false otherwise
func (l *IssuedLicense) Valid() (bool, string) {
if l.KeyID == "" {
return false, "empty key_id"
}

if l.PrivateKey == "" {
return false, "empty private_key"
}

if l.Authorization == "" {
return false, "empty authorization"
}

return true, ""
}

```

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fontconfig/fc-case/CaseFolding.txt

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-----  
fontconfig/src/fcatomic.h

/\*

\* Mutex operations. Originally copied from HarfBuzz.

\*

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\*

\* Contributor(s):

\* Chris Wilson

<chris@chris-wilson.co.uk>

\* Red Hat Author(s): Behdad Esfahbod

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-----  
fontconfig/src/fcfoundry.h

/\*

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\*/

-----  
fontconfig/src/fcmd5.h

/\*

\* This code implements the MD5 message-digest algorithm.  
\* The algorithm is due to Ron Rivest. This code was  
\* written by Colin Plumb in 1993, no copyright is claimed.  
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\*  
\* Equivalent code is available from RSA Data Security, Inc.  
\* This code has been tested against that, and is equivalent,  
\* except that you don't need to include two pages of legalese  
\* with every copy.  
\*  
\* To compute the message digest of a chunk of bytes, declare an  
\* MD5Context structure, pass it to MD5Init, call MD5Update  
\* as  
\* needed on buffers full of bytes, and then call MD5Final, which  
\* will fill a supplied 16-byte array with the digest.  
\*/

-----  
fontconfig/src/fcmutex.h

/\*

\* Atomic int and pointer operations. Originally copied from HarfBuzz.  
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-----  
fontconfig/src/ftglue.[ch]

/\* ftglue.c: Glue code for compiling the OpenType code from  
\* FreeType 1 using only the public API of FreeType 2  
\*  
\* By David Turner, The FreeType Project (www.freetype.org)  
\*  
\* This code is explicitly put in the public domain  
\*  
\* =====  
\*  
\* the OpenType  
\* parser codes was originally written as an extension to  
\* FreeType 1.x. As such, its source code was embedded within the library,  
\* and used many internal FreeType functions to deal with memory and  
\* stream i/o.  
\*  
\* When it was 'salvaged' for Pango and Qt, the code was "ported" to FreeType 2,  
\* which basically means that some macro tricks were performed in order to  
\* directly access FT2 \_internal\_ functions.  
\*  
\* these functions were never part of FT2 public API, and \_did\_ change between  
\* various releases. This created chaos for many users: when they upgraded the

\* FreeType library on their system, they couldn't run Gnome anymore since  
\* Pango refused to link.  
\*  
\* Very fortunately, it's possible to completely avoid this problem because  
\* the FT\_StreamRec and FT\_MemoryRec structure types, which describe how  
\* memory and stream implementations interface with the rest of the font  
\* library, have always been part of the public API, and never changed.  
\*  
\* What we do  
\* thus is re-implement, within the OpenType parser, the few  
\* functions that depend on them. This only adds one or two kilobytes of  
\* code, and ensures that the parser can work with `_any_` version  
\* of FreeType installed on your system. How sweet... !  
\*  
\* Note that we assume that Pango doesn't use any other internal functions  
\* from FreeType. It used to in old versions, but this should no longer  
\* be the case. (crossing my fingers).  
\*  
\* - David Turner  
\* - The FreeType Project ([www.freetype.org](http://www.freetype.org))  
\*  
\* PS: This "glue" code is explicitly put in the public domain  
\*/

## 1.398 acl 2.2.52

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This package was debianized by Nathan Scott [nathans@debian.org](mailto:nathans@debian.org) on  
Tue, 26 Feb 2002 13:25:26 +1100

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the program's name and a brief idea of what it does.>
Copyright (C) <year> <name of author>
```

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Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
Gnomovision version 69, Copyright (C) year name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

The hypothetical commands ``show w'` and ``show c'` should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than ``show w'` and ``show c'`; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the program
`Gnomovision' (which makes passes at compilers) written by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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## 1.408 audit 2.6.5

### 1.408.1 Available under license :

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Constant-time SSSE3 AES core implementation.
version 0.1

By Mike Hamburg (Stanford University), 2009
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## 1.417 libatomic-ops 7.2

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Here the stream cipher has been modified always to include the time when initializing the state. That makes it impossible to regenerate the same random sequence twice, so this can't be used for encryption, but will generate good random numbers.

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To compute the message digest of a chunk of bytes, declare an MD5Context structure, pass it to MD5Init, call MD5Update as needed on buffers full of bytes, and then call MD5Final, which

will fill a supplied 16-byte array with the digest.

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## 1.421 libpkit 0.23.2

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## 1.422 open-vm-tools 10.3.5

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2013.04.16 Dmitry Torokhov <dtor@vmware.com>

This release tag contains commits up to the following id:  
867ea989d5e6889abcac77b4c7dae7db2651df58

2012.12.26 Dmitry Torokhov <dtor@vmware.com>

This release tag contains commits up to the following id:  
530ef7f26ed041ab1b6655f2cdc79f3af97fc50b

2012.10.14 Dmitry Torokhov <dtor@vmware.com>

This release tag contains commits up to the following id:  
d85408321c66c927bffdb05106a26581244edd4a

2012.05.21 Dmitry Torokhov <dtor@vmware.com>

This release tag contains commits up to the following id:  
482332b8d4282df09838df5ea4c58df9cdb4faf3

2012.03.13 Dmitry Torokhov <dtor@vmware.com>

This release tag contains commits up to the following id:  
0114aabd54bf2db4556563b7149c4fbbdec3d87b

2011.12.20 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:  
dfca5cf9d1c2335c5d001deedd9266c84956b508

2011.11.20 Marcelo Vanzin <mvanzin@vmware.com>

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release tag contains commits up to the following id:

6c197b8e5eccf32bfee0e2452d8926968182aada

2011.10.26 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

6271fde90248a4fd49e38aa61498db9e1dbf37c3

2011.09.23 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

05baddbed1c5e47e9789a44d30bb217d7184232a

2011.08.21 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

2b3d76ba776f55d06fb5b62499b189ebd6bc1c75

2011.07.19 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

5bed6f1369ca6e9c2c7fbaf4205d86e50f219c5f

2011.06.27 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

166bbe1d28da4dab763b9568f163c8dca99ced9c

2011.05.27 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

3793ddc9c9b5facf376a2625d4c2252aa9bd3daa

2011.04.25

Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

3112c27981074deb53e86e30e1c168d55e42220c

2011.03.28 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:

ec43520f5f3a50f5a980a73d22ae231380f97555

2011.02.23 Marcelo Vanzin <mvanzin@vmware.com>

This release tag contains commits up to the following id:  
96cf4718ac0aff1743e50a2165599306ba442fe1

2011.01.24 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
60c470337c8932a6d9564130dcaf06c7a1a3df53

2010.12.19 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
5aef2b20a519788613350752575bcba0ac71df79

2010.11.17 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
11c0273ed4269f6f7a92f82f6c822df7da4c8720

2010.10.18 Marcelo Vanzin <mvanzin@vmware.com>  
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release tag contains commits up to the following id:  
2162c5d770cdac3b0e275907a1a5d22ece8ce23c

2010.09.19 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
c92a8bfbb406a906bcd2fb9ef6801f92c5b64d1f

2010.08.24 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
94e63742d734b41638d37580602de4232da5ece6

2010.07.25 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
b15cffc7961b97129d0b77643db42b4d4d8e3da7

2010.06.16 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
ec87703fccdd0f954a118640c0b097e383994391

2010.04.25 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
6fafd672e006208c1e479b297e19618170ff19bd

2010.03.20 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
7cddb623125729b41bf54068568dfbcc2dd58733

2010.02.23  
Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
8baa8588d5fd4cf64efb17164cb70c86c758d0c6

2010.01.19 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
8ee82a5774ae7badeb98ecf4dc629c7e9aac7077

2009.12.16 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
0d28106da5684dc31ea52ebb5a2dc6a0af5c1d61

2009.11.16 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
6f4cdd0f38be020d722f2393c0b78d7cd13f04d2

2009.10.15 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
d2f1b83daab1d7882fd651ad1cc77c729bbd9760

2009.09.18 Marcelo Vanzin <mvanzin@vmware.com>  
This release tag contains commits up to the following id:  
8bb94fbfbd65b53b87279cf81529756dba7a2ca

Other changes not captured in the git logs:

\* Resync with internal dev branch  
(2009.08.24)

\* hgfsmounter/hgfsmounter.c: allow hgfs users to set ttl to 0 at mount time.

\* lib/guestApp/guestApp.c, lib/include/conf.h, lib/include/netutil.h,  
lib/include/procMgr.h, lib/include/system.h, lib/vixTools/vixTools.c,  
lib/vmCheck/vmcheck.c: remove (now unused) Netware checks.

- \* lib/message/\*, modules/freebsd/vmhgfs/Makefile, modules/linux/vmhgfs/Makefile.\*, modules/solaris/vmhgfs/Makefile: remove unused message transport abstraction. The rpcChannel library is now used to do RPC abstraction.
- \* modules/\*/vmmemctl/\*: refactor of the vmmemctl module as part of adding support for Mac OS guests.
- \* modules/linux/pvscsi/pvscsi.c: don't clobber RESERVATION\_CONFLICT sdstat up from linux pvscsi driver.
- \* modules/linux/shared/\*: VMCI changes unrelated to the guest driver.
- \* modules/linux/vmhgfs/fsutil.c, modules/linux/vmhgfs/inode.c: fix the case where two directories refer to the same inode.
- \* scripts/linux/\*: support older versions of NetworkManager.

2009-08-24 Marcelo

Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.08.19)

\* configure.ac: remove support for Linux kernels < 2.6.9.

\* lib/include/vmtools.h, libvmtools/vmtoolsLog.c, doc/api/services/util.txt: add new log handled that allows appending to existing log files, and fix an issue where old log files would be "rotated" whenever the config file was reloaded.

\* lib/appUtil/appUtilX11.c, lib/ghIntegration/ghIntegrationX11.c, lib/include/appUtil.h: fix compilation issues on FreeBSD when unity was enabled.

\* lib/dnd/dndLinux.c, lib/include/vmblock\_user.h, tests/testVmblock/\*: add vmblock tests and, as part of the change, do some refactoring of vmblock related functions.

\* lib/guestInfo/guestInfo.c, lib/include/wiper.h, lib/wiper/\*, toolbox/toolboxcmd-shrink.c, toolbox/toolboxShrink.c: refactor the wiper structures so that they behave the same on Win32 and other platforms, and also reuse data structures already in use by other parts of the code. This fixes an "use after free" issue that toolbox-cmd had on Win32.

\* lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoInt.h, lib/guestInfo/guestInfoPosix.c, lib/guestRpc/nicinfo.x, lib/include/guestInfo.h, lib/include/netutil.h, lib/include/slashProc.h, lib/netutil/netUtilLinux.c, lib/slashProc/\*,

services/plugins/guestInfo/guestInfoServer.c: add support for sending more network-related information to the host, such as routing tables and name servers.

\* lib/hgfsBd/hgfsBd.c: don't log RPC errors when HGFS is disabled.

\* lib/hgfsHelper/\*, lib/include/hgfsHelper.h, lib/vixTools/vixTools.c: new library with functions to query information about HGFS; expose some HGFS properties through VIX.

\* lib/hgfsServer/\*, lib/hgfsServerPolicyGuest/hgfsServerPolicyGuest.c, lib/include/hgfsServerPolicy.h: fix checking of whether an object belongs to a particular share; this was causing issues with invalid information being returned in certain cases.

\* lib/hgfsServer/\*, lib/include/hgfsProto.h: changes to support new VIX API calls (mostly affecting Win32 only).

\* lib/include/guestCaps.h, lib/include/unityCommon.h: add boilerplate for new RPCs for setting windows as sticky / non-sticky (not yet implemented).

\* lib/include/hgfsProto.h: new definitions for the next version of the HGFS protocol.

\* lib/include/xdrutil.h: make XDRUTIL\_ARRAYAPPEND() more type-safe when using GCC.

\* lib/misc/codesetOld.c: fix some issues with UTF16 -> UTF8 conversion.

\* lib/rpcChannel/rpcChannel.c, libvmttools/signalSource.c, libvmttools/vmtools.c, libvmttools/vmtoolsConfig.c: g\_assert -> ASSERT.

\* lib/unityWindowTracker/unityWindowTracker.c: fix issue with z-ordering of modal dialogs.

\* libvmttools/vmtoolsConfig.c: fix some old config translation issues.

\* modules/freebsd/shared/\*, modules/freebsd/vmblock/\*: make vmblock work on FreeBSD 8.

\* modules/freebsd/vmmemctl/\*, modules/linux/vmmemctl/\*,

modules/solaris/vmmemctl/\*, : refactoring and code changes to support the driver on Mac OS X.

\* modules/linux/vmblock/\*, modules/linux/vmci/\*, modules/linux/vsock/linux/\*: remove compatibility code for older kernels.

- \* modules/linux/vmhgfs/\*: fix memory leak in HgfsAccessInt().
  - \* modules/linux/vmxnet3/\*: fix kunmap usage in vmxnet3\_shm, and reset the shared pages when the char device is closed.
  - \* modules/linux/vsock/linux/af\_vsock.{c,h}, modules/linux/vsock/linux/util.c: add vsock protocol negotiation for notifyOn ops. This allows the driver to negotiate with the remote end which version of the notification protocol to use.
  - \* modules/linux/vsock/linux/notify.c, modules/linux/vsock/linux/notify.h, modules/linux/vsock/linux/notifyQState.c, modules/linux/vsock/linux/vsockPacket.h: add pktOn protocol. This new protocol improves performance by detecting changes in the queue state instead of sending WAITING\_READ and WAITING\_WRITE packets.
  - \* services/plugins/hgfsServer/hgfsPlugin.c,  
  
services/plugins/resolutionSet/resolutionSet.c,  
services/vmtoolsd/mainLoop.c, services/vmtoolsd/pluginMgr.c,  
services/vmtoolsd/toolsRpc.c: load plugins even when an RPC channel cannot be instantiated (i.e., when running outside of a virtual machine); this allows plugins to perform actions (at load time) also when running outside virtual machines (e.g., to undo some configuration done when the OS was run in a VM).
  - \* services/vmtoolsd/mainLoop.c, services/vmtoolsd/mainPosix.c, services/vmtoolsd/toolsCoreInt.h: handle SIGHUP differently; instead of stopping the service, just re-load the config data. This should make it easier to integrate the tools service with other tools such as logrotate.
  - \* toolbox/toolbox-cmd.c, toolbox/toolboxcmd-stat.c: remove memory info query, which didn't really return useful information.
  - \* vmware-user/copyPasteUI.cpp: if the clipboard/primary with most recent timestamp has no data on it, try the other before giving up during copy/paste.
- 2009-07-22 Marcelo Vanzin <mvanzin@vmware.com>
- \* Resync with internal trunk (2009.07.17)
  - \* configure.ac: fix detection of "dot" and its usage in the doxygen config file.
  - \* configure.ac, libguestlib/Makefile.am, libguestlib/vmquestlib.pc.in: install vmquestlib headers and add new pkgconfig script.

- \* lib/dndGuest/dnd.{cc,hh}, lib/include/dndBase.h, vmware-user/dndUI.{cpp,h}: fix an issue where the DnD code would prevent drops to other windows in Unity mode, instead of just intercepting drops to the desktop.
- \* lib/dndGuest/dnd.{cc,hh}, lib/dndGuest/dndRpc.hh, lib/dndGuest/dndRpcV3.cc, lib/include/dndBase.h, vmware-user/dndUI.{cpp,h}: fix an issue where the host Unity code would cause an undesired drop event.
- \* lib/dndGuest/dnd.{cc,hh}, lib/dndGuest/dndRpc.hh, lib/dndGuest/dndRpcV3.cc, lib/include/dndBase.h: cleanup mouse simulation code, and fix an issue where a drag would be canceled if the contents were dragged out of a guest and then back in.
- \* lib/dndGuest/dndRpcV3.cc, vmware-user/copyPasteDnDWrapper.cpp, vmware-user/dndUI.cpp, vmware-user/dndUI.h, vmware-user/dragDetWnd.cpp, vmware-user/dragDetWnd.h: several DnD fixes; make the DnD code behave more like other GTK applications (based on analysing the flow of signals on a test widget), and get rid of one of the detection windows, merging both the Unity and non-Unity windows. Also, some code refactoring.
- \* lib/ghIntegration/\*, lib/guestRpc/\*, lib/include/guestCaps.h, lib/include/unityCommon.h: add stubs for a few new GHI functions (setting window focus, tray icon updates and enhanced app info) - currently only implemented on Win32.
- \* lib/ghIntegration/ghIntegrationX11.c: examine WM\_CLASS when determining which DE Tools are running in. The previous code was failing to show a few entries set as "OnlyShowIn=xxx" because checking WM\_NAME wasn't enough to properly detect the desktop environment in certain cases.
- \* lib/guestApp/guestAppPosixX11.c: use gconftool-2 to detect the user's browser, since gnome-open fails to open "file://" URLs which contain query strings. Also, use "kde-open" when running under KDE.
- \* lib/guestInfo/guestInfo.c, lib/include/wiper.h, lib/wiper/wiperPosix.c: allow shrinking LVM partitions.
- \* lib/include/appUtil.h: partial refactoring of icon retrieval code.
- \* lib/include/dblInkLst.h, lib/misc/dblInkLst.c: inline linked list functions.
- \* lib/include/guest\_os.h, lib/misc/hostinfoPosix.c: add a couple of distros to the known distro list.



- \* lib/include/netutil.h, lib/netUtil/netUtilLinux.c: add Linux interface name, index lookup routines.
- \* lib/include/system.h, lib/system/systemLinux.c, services/plugins/timeSync/timeSync.c: fixes a few bugs in the backwards time sync code, mostly due to unit mismatches.
- \* lib/include/unityWindowTracker.h, lib/unity/unity.c, lib/unity/unityPlatform.h, lib/unity/unityPlatformX11Window.c, lib/unityWindowTracker/unityWindowTracker.c: expose two new properties in the window tracker to save an RPC to retrieve those properties.
- \* lib/include/vmtoolsApp.h, services/vmtoolsd/mainLoop.c, services/vmtoolsd/pluginMgr.c, services/vmtoolsd/toolsCoreInt.h: add support for "application providers", which allow plugins to add support to new kinds of application frameworks through vmtoolsd.
- \* lib/unity/unityPlatformX11.c: only enable GIO channels when Unity is actually active.
- \* lib/unity/\*: cleanup old GTK1 code.
- \* libvmtools/vmtoolsConfig.c: don't complain if config file is empty.
- \* modules/linux/dkms.conf, modules/linux/dkms.sh: fix dkms.conf, and provide a script to create a dkms tree from open-vm-tools.
- \* modules/linux/shared/vmci\_queue\_pair.h, modules/linux/vmci/vmciKernelIf.c: remove two (now) unneeded functions.
- \* modules/linux/vmhgfs/\*: code cleanups, properly initialize the list head, and allow receives to timeout so that hibernation works.
- \* modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet3/vmxnet3\_drv.c: fix drivers for kernels 2.6.29+.
- \* modules/linux/vmxnet3/\*: add shared memory support for faster communication between user space and the device backend; this doesn't affect the regular driver functionality, but is used by some VMware code not part of Tools.
- \* modules/linux/vsock/\*: fix an issue where it was possible for users to send VMCI datagrams directly to the hypervisor.
- \* scripts/common/vmware-user.desktop: work around a bug in KDE where desktop files with "NoDisplay" fail to autostart.

- \* scripts/freebsd/suspend-vm-default: use netif to bring down interfaces, since dhclient doesn't understand "-r" in the default install.
- \* services/plugins/vmbackup/\*: add some new code used by enhancements being done in the Win32 version of the plugin.
- \* services/vmtoolsd/mainPosix.c: fix running in background when executing vmtoolsd while relying on PATH.
- \* services/vmtoolsd/Makefile.am:  
point to the correct plugin install directory.
- \* toolbox/\*: better command line handling in the CLI utility, plus some code cleanup.
- \* vmware-user/copyPaste.c, vmware-user/copyPasteDnDWrapper.cpp, vmware-user/copyPasteDnDWrapper.h, vmware-user/dnd.c: properly unregister RPCs to avoid multiple registrations (and the ensuing ASSERT) in certain cases.
- \* vmware-user/copyPasteUI.{cpp,h}: change way data is retrieved from the clipboard, using the gtk+ clipboard wait APIs (which turn out to be more reliable than the previous approach).

2009-06-18 Marcelo Vanzin <mvanzin@vmware.com>

- \* Resync with internal trunk (2009.06.15)
  - \* docs/api/Makefile.am: replace all variables in the doxygen conf file with the correct values.
  - \* lib/appUtil/appUtilX11.c: try alternate file extensions during icon search. Sometimes a package lists its icon as icon-foo.png, but the package didn't include icon-foo.png. Instead, it included icon-foo.xpm. Ex: Ubuntu
- 8.04's hwtest.
- \* lib/guestApp/guestAppPosixX11.c: change detection of the default browser so that the new help system works; the help files are not yet available in open-vm-tools.
  - \* lib/hgfs/\*, lib/include/cpName.h, lib/include/cpNameLite.h, lib/include/hgfsUtil.h: avoid compiling certain parts of the source in kernel modules.
  - \* lib/hgfsServer/\*: return correct error when files / directories don't exist.

- \* lib/include/hgfsChannel.h, modules/linux/vmhgfs/\*: added support for vsock channel for HGFS.
- \* lib/include/util.h, lib/misc/utilMem.c: un-inline a bunch of functions to reduce the size of binaries.
- \* lib/include/vm\_tools\_version.h: bumped Tools version.
- \* lib/resolution/resolutionX11.c: fix for issue where the host would send a "topology set" command with a top-left corner that was not (0, 0) and cause the screen to be reconfigured in the wrong way.
- \* lib/unity/unityPlatformX11Window.c: check for errors in calls to XQueryTree.
- \*  
lib/wiper/wiperPosix.c: check return of fgets() to avoid compiler warnings.
- \* libvmtools/vmtools.c: fix initialization of wiper library on Win32.
- \* modules/Makefile.am: install vsock header file on Linux.
- \* modules/freebsd/vmhgfs/\*, modules/linux/vmci/\*, modules/linux/vsock/\*: changes related to 64-bit Mac drivers, don't affect either the FreeBSD or Linux drivers.
- \* modules/linux/vmhgfs/hgfs.h: removed duplicate file.
- \* modules/linux/vmhgfs/fsutil.c, modules/linux/vmhgfs/inode.c, modules/linux/vmhgfs/module.h: fix issue where two files would get the same inode number in some situations.
- \* modules/linux/vmxnet/vmxnet.c: re-probe vmxnet2 device features on resume from hibernate, to cover the case where a VM is resumed on a platform with a different version of the device backend (bug #2209565).
- \* scripts/resume-vm-default, scripts/suspend-vm-default: use NetworkManager to handle networking where it is available.
- \* services/plugins/hgfsServer/Makefile.am, services/plugins/vix/Makefile.am: fix installation of vmusr plugins that are shared with vmsvc.
- \* services/plugins/timeSync/timeSync.c: fix backwards time sync.
- \* services/vmtoolsd/cmdLine.c, toolbox/toolbox-cmd.c: print build number as part of "-v" output.

- \* toolbox/toolboxcmd-shrink.c: correctly ignore unsupported partitions when shrinking.
- \* toolbox/toolbox-gtk.c: changes for the new help system, not yet available for open-vm-tools.
- \* toolbox/toolboxInt.{c,h}, toolbox/toolboxScripts.c: some code refactoring.
- \* vmware-user/Makefile.am: fix linking when compiling without gtkmm.

2009-05-22 Marcelo Vanzin <mvanzin@vmware.com>

- \* Resync with internal trunk (2009.05.18)
- \* configure.ac, m4/vmtools.m4: check for PAM and enable PAM support when available.
- \* configure.ac, services/plugins/\*/Makefile.am, tests/\*/Makefile.am: avoid the "-rpath" hack to create plugins, using plugin\_LTLIBRARIES instead (and manually fixing things when necessary). Thanks to Dominique Leuenberger for the suggestion (and sample patch).
- \* docs/api/Makefile.am: fix doc target directories.
- \* configure.ac, lib/Makefile.am, lib/deployPkg/\*, lib/include/deployPkg.h: remove the deployPkg code, which depends on some VMware code that is not yet open source.
- \* lib/backdoor/\*, lib/hgfs/\*, lib/hgfsBd/\*, lib/include/\*, lib/include/compat/\*, lib/message/\*, lib/misc/dbllnk1st.c, lib/rpcOut/rpcout.c: as part of sharing code between user-level code and kernel modules, some files have been tagged with more than one license.
- \* lib/dndGuest/\*, lib/include/dndBase.h, lib/include/dndMsg.h, lib/include/unity\*, lib/unity/unityPlatformX11.c: implement mouse movement from within the guest; this avoids a dependency on "unofficial" mouse APIs in the VMware host code, making DnD more reliable, and makes a few things (such as cancelling an ongoing DnD operation) easier.
- \* lib/file/filePosix.c: make File\_FullPath()'s behavior consistent when the input path starts with a '/'.
  - \* lib/ghIntegration/ghIntegration.c: send more info about the "start menu" contents to the host (only usable for Windows guests).
  - \* lib/ghIntegration/ghIntegrationX11.c: prettify the category names of menu items. This is a temporary solution before actually reading this

information from .desktop files.

\* lib/guestApp/guestApp.c, libguestlib/vmGuestLib.c, lib/include/guestApp.h, toolbox/toolbox-gtk.c, vmware-user/foreignVM\*, vmware-user/vmware-user.cpp, configure.ac, lib/Makefile.am, lib/include/socketMgr.h, lib/socketMgr.\*: remove code related to "foreign VM" support, which was never really used.

\* lib/guestInfo/guestInfo.c, lib/include/wiper.h, lib/wiper/wiperPosix.c: properly report disk info for LVM volumes.

\* lib/hgfsServer/hgfsDirNotify\*, lib/hgfsServer/hgfsServer.c: add support for directory / file monitoring. It's currently only implemented on Mac OS X.

\* lib/hgfsServer/hgfsServer\*: fix issue where it was possible to create a file on a read-only share on Windows hosts.

\* lib/hgfsServer/hgfsServer\*, lib/hgfsServerManagerGuest\*, lib/include/hgfs\*.h, services/plugins/hgfsServer/hgfsPlugin.c, services/plugins/vix/foundryToolsDaemon.c: some refactoring caused by the work to make HGFS support pluggable transports.

\* lib/include/procMgr.h, lib/procMgr/procMgrPosix.c: remove ProcMgr\_GetAsyncStatus().

\* lib/include/vmsupport.h, scripts/vm-support, xferlogs/xferlogs.c, services/plugins/guestInfo/guestInfoServer.c: new feature to automatically collect support data from the guest from the VMware UI.

\* lib/panicDefault\*, lib/user\*: change file names to avoid clash with another file (Mac OS linker doesn't really like that).

\* lib/rpcChannel/rpcChannel.c: try to reinitialize the outbound channel on failure.

\* lib/vixTools/vixTools.c, lib/include/vixCommands.h, lib/include/vixOpenSource.h: add backend for new VIX API call to list the guest's filesystems.

\*

libvmtools/vmtoolsLog.c: lazily open the log file, instead of opening it during configuration of the log system. This way two processes can use the same conf file and not overwrite each other's log files (assuming the conf data is sane).

\* modules/Makefile.am, modules/linux/vmci/Makefile.kernel, modules/linux/vsock/Makefile.kernel: don't store VMCI module symbols in

/tmp during build; this avoids a possible symlink attack that could cause data to be overwritten when building open-vm-tools.

\* modules/\*/\*, vmblock-fuse/\*: remove a lot of duplicated files by either moving them to a shared location or reusing files that were already available elsewhere.

\* modules/freebsd/vmblock/subr.c, modules/freebsd/vmblock/vmblock\_k.h, modules/freebsd/vmblock/vnoops.c: fix a possible kernel crash caused by trying to read / write to the mount point (something vmware-user does to detect whether it's using fuse or non-fuse vmblock).

\* modules/linux/pvscsi/\*: adds support for a generic msg framework that is currently used to deliver hot-plug/unplug notifications; get rid of a few divisions; fix a bug where pvscsi\_probe could return 0 (aka success) if a call to kmalloc() failed; remove a few unused fields.

\* modules/linux/shared/vmci\*: mostly changes related to the host VMCI drivers (removed user-level queue-pair daemon, added support for trusted VMCI endpoints) to keep binary compatibility between the host and guest VMCI drivers.

\* modules/linux/hgfs/inode.c: check host's access rights when checking file permissions, so that permissions are correctly checked when the guest's user id is different from the host's user id.

\* modules/linux/bdhandler.\*, modules/linux/filesystem.c; modules/linux/tcp.\*, modules/linux/transport.\*: postpone opening the channels so that module can load successfully even if shared folders are disabled on the host; fix a synchronization problem between recv and close/open; allow

hibernation to work by timing out the recv thread; correctly handle failures in recv, including injecting a dummy error to the pending requests when the recv thread exits; move the recv code to the channel's implementation so that it can be simpler.

\* modules/linux/vmxnet3/vmxnet3.c, modules/linux/shared/compat\_pci.h: fix Wake-On-LAN for 2.6.27 and newer Linux guests.

\* modules/linux/vsock/linux/\*: changes to support trusted VMCI host apps; pull out notification and stats logging code into their own files.

\* modules/solaris/vmhgfs/vnode.c: do not substitute errors returned by uiomove() calls with EIO, propagate returned error code (which is EFAULT) up the stack.

\* services/vmtoolsd/Makefile.am, scripts/common/linux/pam.d/vmtoolsd-x64,

scripts/common/linux/pam.d/64/vmtoolsd: install the 64-bit PAM config file with the correct name.

\* services/plugins/powerOps/powerOps.c: fix running default scripts by making sure the path to the script is absolute.

\*

services/vmtoolsd/Makefile.am, services/vmtoolsd/pluginMgr.c: use info from the configure step to define the plugin path; this avoids requiring a symlink to be placed in /etc/vmware-tools for vmtoolsd to be able to find the plugins.

\* services/vmtoolsd/toolsRpc.c: send the build information to the host so it's logged in the VM's logs.

\* toolbox/toolbox-cmd.c, toolbox/toolboxcmd-\*, toolbox/toolboxCmdInt.h: make string comparison case-insensitive on Win32.

\* toolbox/toolboxcmd-shrink.c: properly finish the shrinking process by sending the "disk.shrink" RPC to the host.

\* toolbox/toolboxScripts.c: fix showing default settings for power ops scripts (should show default script enabled, not script disabled).

\* vmblock-fuse/Makefile.am: fix compilation on FreeBSD.

\* vmware-user/copyPasteUI.cpp: disallow copy-paste text of size greater than 4MB, instead of truncating the data.

\* vmware-user/dndUI.\*, lib/dndGuest/dnd.cc, lib/include/dndBase.h: remove

drag timeout callback (which was not needed), and add new signal to indicate that a GH DnD was cancelled.

\* vmware-user/Makefile.am: remove C++ link hack (not needed now since vmware-user has C++ code already).

2009-04-23 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.04.17)

\* configure.ac, Makefile.am, docs/\*: build API docs for vmtools; the documentation files are provided under a BSD-style license.

\* configure.ac, Makefile.am, guestd/\*, lib/Makefile.am, lib/guestInfo/\*, lib/include/vmbackup\_def.h, lib/include/vmBackup.h, lib/vmBackupLib/\*, libvmtools/Makefile.am, services/plugins/vmbackup/vmbackup\_def.h: remove guestd from open-vm-tools, and clean up code in other places that was only there because of guestd.

- \* configure.ac, modules/solaris/vmblock/\*, modules/solaris/vmmemctl/\*: add Solaris vmblock and vmmemctl driver sources. The vmmemctl module also includes a user-level daemon (vmmemctld.c).
  
- \* lib/conf/conf.c, lib/include/conf.h,  
libvmtools/vmtoolsConfig.c: remove unused config options.
  
- \* lib/deployPkg/toolsDeployPkg.h: code refactoring.
  
- \* lib/dnd/dndClipboard.c: if size of clipboard exceeds the maximum backdoor packet size, only keep text data (dropping the RTF data).
  
- \* lib/dnd/dndLinux.c, lib/include/dnd.h, lib/include/vmblock.h,  
vmware-user/copyPaste.c, vmware-user/dnd.c, vmware-user/vmware-user.cpp,  
vmware-user/vmwareuserint.h, vmware-user-suid-wrapper/main.c: detect whether plain vmblock or vmblock-fuse is being used, allowing the same executable to be used with either.
  
- \* lib/dndGuest/\*, vmware-user/copyPaseDnDWrapper.{cpp,h},  
vmware-user/dndUI.{cpp,h}, vmware-user/dragDetWnd.{cpp,h}:  
vmware-user/vmware-user.cpp: more DnD V3 protocol work.
  
- \* lib/ghIntegration/\*, lib/include/guestCaps.h, lib/include/unityCommon.h:  
work related to mapping Outlook folders over HGFS and exposing the Windows Recycle Bin to the host (doesn't really affect open-vm-tools).
  
- \*
- lib/ghIntegration/ghIntegrationX11.c: restore the native environment when launching external applications. This doesn't really affect open-vm-tools.
  
- \* lib/guestRpc/\*, vmware-user/copyPasteUI.{cpp,h}: implement RTF and file contents copy & paste.
  
- \* lib/include/circList.h, lib/include/vm\_basic\_math.h,  
lib/include/vm\_device\_version.h, modules/linux/\*, modules/Makefile.am:  
changes to share files between the user space code and the kernel code,  
instead of duplicating the same source files in different places.
  
- \* lib/include/rpcChannel.h, lib/rpcChannel/\*, tests/testDebug/testDebug.c,  
test/vmrpcdbg/debugChannel.c: some code cleanup, and fix crash when dealing with multiple reset messages.
  
- \* lib/include/system.h, lib/system/systemLinux.c,  
services/vmtoolsd/mainPosix.c: remove System\_Daemon() (replaced with Hostinfo\_Daemonize()).



- \* lib/include/unityCommon.h, lib/unity/\*: resurrect UNITY\_RPC\_WINDOW\_SHOW and UNITY\_RPC\_WINDOW\_HIDE RPCs.
- \* lib/procMgr/procMgrPosix.c:  
fix ProcMgr\_IsProcessRunning().
- \* lib/system/systemLinux.c: fix shutdown / reboot commands on Solaris; fix rebuilding of native environment from variables set by VMware scripts (this last one doesn't really affect open-vm-tools).
- \* lib/unicode/unicodeSimpleTypes.c: speed up UnicodeIANALookup, and fix case where C++ constructors could call UnicodeIANALookup before Unicode\_Init() was called by lazily creating the internal cache.
- \* libguestlib/\*: link libguestlib against libvmttools. This avoids having two definitions of certain symbols (like Debug()) when an application links to both libraries.
- \* modules/linux/vmblock/linux/control.c: only set directory entry owner when needed.
- \* modules/linux/vmhgfs/bdhandler.{c,h}, modules/linux/vmhgfs/dir.c, modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/filesystem.c, modules/linux/vmhgfs/fsutil.c, modules/linux/vmhgfs/inode.c, modules/linux/vmhgfs/module.{c,h}, modules/linux/vmhgfs/page.c, modules/linux/vmhgfs/request.{c,h}, modules/linux/vmhgfs/super.c, modules/linux/vmhgfs/tcp.{c,h}, modules/linux/vmhgfs/transport.{c,h}: cleanup use of atomic variables in HGFS; add a transport abstraction layer, and add an initial version of a socket-based transport (not yet stable and not yet supported by any released VMware product).
- \* modules/linux/vmxnet3/vmxnet3.c: fix build on kernel 2.6.29.
- \* modules/linux/vsock/af\_vsock.c: export more functions to other kernel modules; some changes to statistics gathering code.
- \* modules/solaris/vmhgfs/filesystem.c: make module loadable on Solaris 9.
- \* modules/solaris/vmhgfs/vnode.c: unify mapping of HGFS to Solaris error codes.
- \* scripts/\*: restart network before running user scripts in resume scripts.
- \* services/plugin/powerOps/powerOps.c: fix running default power scripts.
- \* services/vmtoolsd/pluginMgr.c: better error logging.

\* toolbox/toolbox-cmd.c: fix help string.

\* vmblock-fuse/block.c: fix vmblock-fuse compilation on FreeBSD.

2009-03-18 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.03.13)

\* configure.ac: check for FreeBSD kernel tree when building modules; warn about which version of make to use when building kernel modules on FreeBSD and Solaris; add compiler defines for identifying Solaris 9 and 11.

\* configure.ac, modules/Makefile.am: handle SYSDIR on FreeBSD.

\* guestd/main.c, modules/solaris/vmhgfs/Makefile: remove HGFS-related that is now obsolete with the recent changes to the HGFS module on Solaris.

\* guestd/toolsDaemon.c: default to the configuration dir when the power script path is not absolute.

\* guestd/toolsDaemon.c, lib/include/guestInfo.h, lib/netUtil/netUtilLinux.c: handle case when all network interfaces have been disabled and send an "unknown" IP address to the host.

\* guestd/toolsDaemon.c, services/vmtoolsd/toolsRpc.c: always send TOOLS\_VERSION\_UNMANAGED from an open-vm-tools build, so there's no need for a config file option anymore.

\* hgfsclient/\*: make it link to libvmtools to avoid code duplication.

\* lib/appUtil/appUtil.c: update list of "skippable" apps when figuring out an application's path.

\* lib/auth/authPosix.c, scripts/linux/pam.d/\*, guestd/Makefile.am, services/vmtoolsd/Makefile.am : change the name of the PAM application to "vmtoolsd" to reflect the new service name.

\* lib/dnd/dndFileContentsUtil.h, lib/dnd/dndInt.h, lib/dndGuest/\*.hh, and corresponding files in lib/include: relocate private headers.

\* lib/ghIntegration/ghIntegration.c, lib/ghIntegration/ghIntegrationInt.h, lib/ghIntegration/ghIntegrationX11.c, lib/include/unityCommon.h: glue code for Outlook mirrored folder, which does not affect open-vm-tools.

\* lib/guestRpc/guestlibV3.x, lib/include/vmGuestLib.h, libguestlib/vmGuestLib.c: add new guestlib counters.

- \* lib/include/conf.h, toolbox/toolbox-gtk.c: remove the need for the "helpdir" config option; this doesn't really affect open-vm-tools since the help files are not yet included.
- \* lib/include/guest\_os.h, lib/misc/hostinfoPosix.c: more guest OS names; fix name used to identify Solaris to match what VMware's host code expects.
- \* lib/include/guestStats.h: documentation changes.
- \* lib/include/hostinfo.h, lib/user/hostinfoPosix.c: add a new function that behaves like daemon(3), but is more Mac OS-friendly.
- \* lib/include/toolsLogger.h, lib/Makefile.am, lib/toolsLogger/\*: removed library, which is not used anymore.
- \* lib/include/vm\_basic\_types.h, lib/misc/timeutil.c: fixes to compile under (Open) Solaris 11.
- \* lib/include/vmtoolsApp.h, services/plugins/vmbackup/stateMachine.c, services/vmtoolsd/mainLoop.c, services/vmtoolsd/mainPosix.c, services/vmtoolsd/serviceObj.c, services/vmtoolsd/toolsCoreInt.h: add new signal handler to gather debugging information from a running vmtoolsd instance.
- \* lib/misc/posixPosix.c: fix off-by-one error.
- \* lib/unity/unity.c, lib/unity/unityPlatform.h, lib/unity/unityPlatformX11.c, lib/unity/unityPlatformX11Settings.c: always send Unity updates using RPCI; this avoids a possible race between replying to an incoming RPC and sending an Unity update from a different thread; also, API documentation updates.
- \* lib/unity/unityPlatformX11.c: verify the DnD detection window was initialized before actually using it.
- \* lib/unity/unityPlatformX11Settings.c, lib/unity/unityPlatformX11Window.c: reset \_NET\_WM\_DESKTOP as necessary before exiting Unity; this could cause guest taskbars to disappear when in Unity mode.
- \* lib/unity/unityPlatformX11.c, lib/unity/unityPlatformX11Window.c, lib/unity/unityX11.h: examine WM\_CLIENT\_LEADER when gathering application information; certain applications use this property to define the window where the WM\_COMMAND property should be.
- \* lib/vixTools/vixTools.c: do not follow symlinks when deleting files in the guest using the VIX API.

- \* libvmtools/vmtools.c,  
libvmtools/vmtoolsLog.c: allow the logging subsystem to be re-configured, and clean up the logging data when unloading the library; allow \${USER} and \${PID} to be used in log file paths.
- \* modules/freebsd/vmblock/subr.c, modules/freebsd/vmblock/vnops.c: fix kernel panic on FreeBSD 7.
- \* modules/linux/\*/Makefile: remove GCC version check.
- \* modules/linux/\*/compat\_wait.h: fix COMPAT\_DEFINE\_WAIT for "vanilla" 2.4 kernels.
- \* modules/linux/vmhgfs/Makefile.normal: fix build of HGFS module on 2.4 kernels.
- \* modules/linux/vmxnet/\*, modules/linux/vmxnet3/\*: avoid using compat functions when they're not needed; add compatibility functions for newer Linux kernels.
- \* modules/linux/vsock/linux/af\_vsock.c: fix two races; one when the socket state changed between calls to VSocketVmcRecvStreamCB and VSocketVmcRecvPktWork, and another when trying to read from the socket after a RST arrived after the socket got a detach notification.
- \* modules/solaris/vmxnet3/\*:  
add Solaris vmxnet3 driver.
- \* rpctool/\*: add "rpctool", a simple, stand-alone tool to send RPC commands to the host software.
- \* services/plugins/guestInfo/guestInfoServer.c: don't cache configuration data.
- \* services/plugins/guestInfo/perfMonLinux.c: fix problem with overwriting flags after GuestInfoMonitorReadMeminfo() was called. (Same as fix to lib/guestInfo on previous release.)
- \* services/plugins/powerOps/powerOps.c: handle power ops-related options sent from the host.
- \* services/vmtoolsd/mainLoop.c: handle re-loading the configuration file.
- \* services/vmtoolsd/mainPosix.c: exec after forking on Mac OS, since CoreFoundation classes don't work after a fork.
- \* services/vmtoolsd/pluginMgr.c: allow both 32 and 64 bit plugins to be installed on Solaris by loading them from the appropriate directory;

add library loading code that is not really needed (nor used) in open-vm-tools.

\* services/vmtoolsd/toolsRpc.c: send another "capability" the host expects from Tools.

\* toolbox/toolbox-gtk.c: add F1 shortcut to invoke help.

\* toolbox/toolboxScripts.c: fix issue with freeing data that should not be freed.

\* vmware-user/\*: implement the new DnD protocol (V3).

2009-02-18 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.02.13)

\* configure.ac, m4/vmtools.m4: clean up a lot of the library detection code.

\* configure.ac: remove support for gtk+ 1.2 (code already depended on it in any case); enforce need for glib 2.6.0 or later due to new code being added; add detection for gtkmm; check for C++ compiler when it's needed; reorder the include path to avoid clashing with system headers in some situations.

\* guestd/foundryToolsDaemon.\*, vmware-user/foundryToolsDaemon.\*, guestd/Makefile.am, vmware-user/Makefile.am: moved shared source files to a new place to avoid duplication.

\* hgfsmounter/hgfsmounter.c: add support for Solaris.

\* lib/appUtil/appUtilX11.c: fix loading of icons when the name has a period.

\* lib/dnd/dndClipboard.c, lib/dnd/dndInt.h, lib/dnd/dndMsg.c, lib/dnd/Makefile.am, lib/dndGuest/\*, lib/include/copyPasteBase.h, lib/include/copyPaste.hh, lib/include/copyPasteRpc.hh, lib/include/copyPasteRpcV3.hh, lib/include/dndBase.h, lib/include/dndClipboard.h, lib/include/dndFileContentsUtil.h, lib/include/dndFileList.hh, lib/include/dnd.h, lib/include/dnd.hh, lib/include/dndInt.h, lib/include/dndMsg.h, lib/include/dndRpc.hh, lib/include/dndRpcV3.hh, lib/include/dndTransportGuestRpc.hh, lib/include/dndTransport.hh, lib/include/libExport.hh, vmware-user/copyPaste.cpp, vmware-user/copyPasteUI.{cpp,h}, vmware-user/copyPasteV3.h, vmware-user/copyPasteWrapper.{cpp,h}, vmware-user/dnd.cpp, vmware-user/Makefile.am, vmware-user/vmware-user.{c,cpp}, vmware-user/vmwareuserInt.h,

- vmware-user/stringxx/string.{cc,hh}, vmware-user/stringxx/ubstr\_t.hh: add support for new version of the DnD protocol.
- \* lib/guestInfo/guestInfoPerfMonLinux.c:  
fix problem with overwriting flags  
after GuestInfoMonitorReadMeminfo() was called.
  - \* lib/guestRpc/guestlibV3.x, lib/include/vmGuestLib.h,  
libguestlib/vmGuestLib.c: add new host stats.
  - \* lib/guestRpc/Makefile.am: fix a few compatibility issues with non-GNU versions of make.
  - \* lib/hgfsServer/hgfsServer.c, lib/hgfsServer/hgfsServerInt.h,  
lib/hgfsServer/hgfsServerLinux.c, \*/hgfsProto.h,  
modules/freebsd/vmhgfs/vnops.c, modules/freebsd/vmhgfs/vnopscommon.{c,h}:  
don't trust the local VFS layer, check the HGFS server to see if an operation would succeed.
  - \* lib/include/rpcChannel.h, lib/rpcChannel/\*: add new Guest RPC channel abstraction library used by the new "core services" code.
  - \* lib/include/vmrpcdbg.h, tests/\*: add test code from the "core services" project.
  - \* lib/include/vmtoolsApp.h, lib/include/vmtoolsd\_version.h,  
services/vmtoolsd/\*: add "vmtoolsd", the new service "shell" used in the "core services" project.
  - \* lib/unity/unityPlatformX11Window.c:  
don't send initial "region" updates for  
shaped windows. This works around an issue where resizing a shaped window would not work as expected in Unity mode.
  - \* lib/wiper/wiperPosix.c: fix major number detection for disks on newer Linux kernels.
  - \* libvmtools/Makefile.am: link more libraries needed by vmtoolsd and the new plugins.
  - \* modules/linux/pvscsi/pvscsi.c, modules/linux/pvscsi/pvscsi\_version.h: use PCI-specific memory allocation functions and update driver version.
  - \* modules/linux/vmci/vmciKernelIf.c: disable queue pair support in the host version of the driver on older Linux kernels. This doesn't affect the guest driver.
  - \* modules/linux/vmci/vmci\_queue\_pair.h: implement MSG\_PEEK support on

Linux driver.

- \* modules/linux/vmhgfs/bdhandler.c, modules/linux/vmhgfs/compat\_sched.h, modules/linux/vmmemctl/os.c: fix issue with HGFS module interfering with suspend / hibernation on newer Linux kernels (bug #2523263).
- \*  
modules/linux/vmhgfs/compat\_cred.h, modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/filesystem.c, modules/linux/vmhgfs/inode.c: changes for compatibility with newer Linux kernels, where it's not possible to change fsuid/capabilities directly anymore.
- \* modules/linux/vmhgfs/compat\_pagemap.h, modules/linux/vmhgfs/page.c: fix warning, and compatibility changes for newer Linux kernels (2.6.28.1 and newer; bug #2530616).
- \* modules/linux/vmhgfs/inode.c: fix creation of symlinks (bug #2531303).
- \* modules/linux/vmxnet/vmxnet.c: use PCI-specific memory allocation functions.
- \* modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet3/vmxnet3.c: add option to disable LRO.
- \* modules/linux/vsock/af\_inet.{c,h}, modules/linux/vsock/util.{c,h}: add MSG\_PEEK support; remove ifdefs that were disabling support for queue pairs on the host kernel module; fix compilation with certain versions of gcc (bug #2531283).
- \* modules/solaris/vmhgfs/\*: move backdoor handling code to the HGFS driver; this makes the user-level code to handle the driver (currently in vmware-guestd) obsolete.
- \* modules/solaris/vmxnet/\*: add vmxnet driver for Solaris, under the CDDL.
- \* services/plugins/\*: add all currently available "core services" plugins. The current set of plugins provide the functionality available in vmware-guestd; there are a few plugins that replace functionality from vmware-user, but not all features are ported yet (and vmtoolsd - with vmware-user plugins - and vmware-user cannot run at the same time).
- \* toolbox/toolboxAbout.c: fix the copyright character.
- \* toolbox/toolbox-cmd.c: reword a few messages, fix typos.
- \* toolbox/toolboxCmdInt.h, toolbox/toolboxcmd-record.c, toolbox/toolbox-gtk.c, toolbox/toolboxRecord.c: remove the "record"

functionality from tools (due to internal request).

\* toolbox/toolboxInt.c, toolbox/toolboxScripts.c, toolbox/toolbox-scripts.c:  
changes to use the new config file format used by the  
"core services" code.

\* \*/Makefile.am: make sure 'rm' and 'mv' are being used instead of \$(RM) and  
\$(MV) (which are not defined by automake; bug #2492040).

2009-01-21 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2009.01.19)

\* configure.ac: detect the presence of FUSE libraries.

\* configure.ac, Makefile.am: compile kernel modules for Solaris, and  
vmblock-fuse module if FUSE is available.

\* lib/ghIntegration/ghIntegrationX11.c: retrieved localized application  
names.

\* lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoPosix.c,  
lib/include/hostinfo.h, lib/misc/hostinfo\_misc.c, lib/misc/hostinfoPosic.c,  
lib/vixTools/vixTools.c: refactoring to move code shared with other VMware  
products to a common library.

\* lib/guestRpc/guestlibV3.x, lib/guestRpc/Makefile.am,  
lib/include/vmGuestLib.h, libguestlib/\*: add new iteration of the  
"guestlib" protocol. This is a more extensible solution than the current  
protocol, and should make it easier  
to add new information when needed.

\* lib/include/dynarray.h, lib/include/dynbuf.h, lib/misc/dynarray.c,  
lib/misc/dynbuf.c: make some DynArray/DynBuf functions inline for speed.

\* lib/include/unityCommon.h: more documentation about the Unity protocol.

\* lib/unity/unityPlatformX11.c: fix Unity<->guest desktop ID mappings.

\* libvmtools/vmtoolsLog.c: change the way log domains are configured; now  
sub-domains inherit the default handler for the app if no handler is  
specified.

\* modules/freebsd/vmhgfs/state.c, modules/freebsd/vmhgfs/state.h,  
modules/freebsd/vmhgfs/vnopscommon.{c,h}: implement support for mmap on  
the Mac OS driver, which allows running executables from an HGFS  
share. The FreeBSD module still does not support this functionality.

\* modules/freebsd/vmhgfs/transport.{c,h}: refactoring for sharing structure



definitions.

\* modules/linux/pvscsi/pvscsi.c, modules/linux/vmblock/linux/module.c,  
modules/linux/vmci/vmci\_drv.c, modules/linux/hgfs/module.c,

modules/linux/vmmemctl/os.c, modules/linux/vmsync/sync.c,  
modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet3/vmxnet3.c: add support  
for Novell's proprietary module info tag ("supported").

\* modules/linux/vmci/vmciKernelIf.c: add support for VMCI queue pairs on  
the host. This does not affect the driver when it runs inside virtual  
machines.

\* modules/linux/vmci/\*.h, modules/linux/vsock/\*.h: some changes in the common  
code to support Mac OS X, and also queue pairs on the Solaris VMCI module.

\* modules/linux/vsock/af\_vsock.{c,h}: add functions for registering with  
the vsock driver from within the kernel.

\* modules/linux/\*/Makefile: add \$(LINUXINCLUDE) to the compiler flags; this  
allows compiling the modules against recent kernels which removed that  
from \$(KBUILD\_CPPFLAGS).

\* modules/Makefile.am: add support for compiling Solaris kernel modules.

\* modules/solaris/vmhgfs/\*: initial release of the Solaris HGFS driver in  
open-vm-tools. Driver  
is licensed under the CDDL 1.0.

\* vmblock-fuse/\*: add the user-level implementation of the vmblock driver,  
which is build on top of FUSE, to open-vm-tools. vmware-user hasn't yet  
been modified to use this version of vmblock.

\* vmware-user/copyPaseV3.h: new header introduced during development of the  
next version of copy paste / DnD for X11 platforms.

2008-11-23 Marcelo Vanzin <mvanzin@vmware.com>

\* Resync with internal trunk (2008.12.19)

\* configure.ac, \*/Makefile.am: standardize on using libtool archives for  
the libraries. This also means several makefiles were removed, since  
there's no need to build two archives of the same library anymore.

\* configure.ac: add logic to detect glib 2.6; this is the minimum version  
required by the "Core Services" project. Currently it's an optional  
dependency.

- \* configure.ac: disable Unity when user specifies --disable-multimon.
- \* configure.ac: actually build the pvscsi modules if the detected kernel version supports it.
- \* configure.ac, Makefile.am, lib/guestInfo/Makefile.am, lib/stubs/Makefile.am, lib/vmtools/\*, lib/include/vmtools.h: add the "vmtools" shared library used in the "Core Services" project. The library is a collection of a lot of other libraries used by most VMware Tools programs, and adds some functionality on top of glib that is used in the "Core Services" project. Currently no other components from that project are available as part of open-vm-tools.
- \* lib/deployPkg/deployPkgLog.h, lib/deployPkg/toolsDeployPkg.h: moved private headers out of the public header directory.
- \* lib/guestRpc/Makefile.am, modules/Makefile.am: fix the makefiles so that it's possible to build open-vm-tools from a directory different from the source dir.
- \* lib/hgfsServer/hgfsServer.c: changes to support aliases on Mac OS hosts.
- \* lib/hgfsServer/hgfsServerLinux.c: changes to map Windows attributes to Mac OS FileInfo.
- \* lib/include/circList.h: removed unused file.
- \*
- lib/include/unityCommon.h, lib/unity/unity.c: changes to add documentation to various application RPCs used in Tools.
- \* lib/misc/posixPosix.c, toolbox/toolboxScripts.c: fix include path for syslimits.h on FreeBSD.
- \* lib/unity/unityPlatformX11.c: better detection of the guest's work area boundaries; fixes a problem when dragging a Window in Unity mode with the host's task bar on the left/right of screen would result in weird behavior.
- \* lib/unity/unityPlatformX11Settings.c, lib/unity/unityPlatformX11Window.c, lib/unity/unityX11.h: preserve the \_NET\_WM\_DESKTOP setting when hiding windows; this fixes a problem where hiding a panel and later restoring it would result in the wrong \_NET\_WM\_DESKTOP property being set for the panel, causing it to only display on the first virtual desktop.
- \* modules/linux/vmci/\*: minor changes related to internal development of the Mac OS drivers.

- \* modules/linux/vmhgfs/page.c: fix HGFS driver for kernel 2.6.28.
- \*  
modules/linux/vsock/linux/af\_vsock.c: added code to gather some performance statistics for the driver.
- \* toolbox/toolbox-gtk.c: a few fixes to the help functionality.
- \* vmware-user/vmware-user.c, vmware-user-suid-wrapper/main.c: change the "blockFd" argument to have an extra dash so it follows the convention of common command line parsing libraries.
- \* Other bug fixes and changes in shared code that don't affect open-vm-tools.

2008-11-18 Marcelo Vanzin <mvanzin@vmware.com>

- \* Resync with internal trunk (2008.11.14)
- \* lib/include/vm\_version.h: Bumped TOOLS\_VERSION.
- \* guestd/toolsDaemon.c, lib/include/vm\_app.h: changes related to host-side configuration of power operations.
- \* hgfsclient/hgfsclient.c, lib/dnd/dndCommon.c, lib/dnd/dndLinux.c, lib/hgfs/\*, lib/hgfsServer/\*, lib/include/cpName.h, lib/include/dnd.h, lib/include/hgfsEscape.h, lib/include/staticEscape.h, modules/\*/vmhgfs/\*, vmware-user/dnd.c: refactor the HGFS character escaping code; escape invalid characters when the sender allows characters in the file name that the receiver does not allow.
- \* lib/hgfsServer/hgfsServerLinux.c: return proper error code when the remote path points to a non-existent directory.
- \* lib/deployPkg/deployPkg.c, lib/deployPkg/deployPkgLog.c, lib/include/deployPkg.h, lib/include/rpcin.h, lib/rpcin/rpcin.c: refactoring for the Tools Core Services project.
- \* lib/dnd/dndCommon.c: don't ASSERT if the staging directory is not actually a directory.
- \* lib/dynxdr/xdrutil.c, lib/include/xdrutil.h: more XDR-related utility functions.
- \* lib/file/file.c, lib/file/fileLockPrimitive.c, lib/include/vm\_basic\_defs.h: replace use of strtok with strtok\_r.
- \* lib/guestApp/guestApp.c, lib/include/guestApp.h: more utility functions.

- \* lib/guestApp/guestApp.c, lib/include/backdoor\_def.h, vmware-user/pointer.c:  
add the ability to detect whether the mouse hardware can be used in  
absolute mode, which allows for auto grab /  
auto ungrab to work.
- \* lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoPosix.c,  
lib/guestRpc/nicinfo.x: provide the prefix length of an IPv6 address in a  
separate field of the NicInfo struct.
- \* lib/guestInfo/guestInfoPerfMonLinux.c: reduce log spew.
- \* lib/guestInfo/guestInfoServer.c, lib/include/guestInfo.h: changes related  
to how the VMware code in the host handles Tools version information.
- \* lib/include/unityCommon.h: changes related to documenting the Unity API.
- \* lib/include/unity.h, lib/unity/\*: remove a few unused RPCs, add a new  
function used to notify the host of the status of Unity.
- \* modules/freebsd/vmhgfs/state.c, modules/vmhgfs/freebsd/vnops.c,  
modules/vmhgfs/freebsd/vnopscommon.\*: support symlinks on FreeBSD and  
Mac OS.
- \* modules/freebsd/vmhgfs/worker.c: fix mutex not being unlocked in some  
error paths.
- \* modules/linux/dkms.conf: add rudimentary dkms support.
- \* modules/linux/pvscsi/\*: add a driver for VMware's paravirtualized  
SCSI  
device.
- \* modules/linux/\*/Makefile, modules/linux/vmci/Makefile.kernel,  
modules/linux/vsock/Makefile.kernel: add support for exporting symbols,  
needed for dependent modules to load if a kernel  $\geq$  2.6.26 is compiled  
with CONFIG\_MODVERSIONS. Make the vsock module reference the vmci module's  
symbols.
- \* modules/vmmemctl/freebsd/os.c: add sysctl to get driver status. Information  
can be retrieved with "sysctl vm.vmmemctl".
- \* modules/linux/vmci/vmci\_defs.h, modules/linux/vmci/vmci\_call\_defs.h,  
modules/linux/vsock/vmciHostKernelAPI.h: changes related to VMCI work  
on VMware ESX.
- \* modules/linux/vsock/linux/\*: improve performance of some applications by  
improving the poll behavior and sending less packets when waiting

for a response.

- \* modules/linux/vmsync/sync.c: fix panic on kernels < 2.6.20.
- \* modules/linux/vmxnet3/vmxnet3.c, modules/linux/vmxnet3/vmxnet3\_int.h, modules/linux/vmxnet3/vmxnet3\_version.h: inherit net device features to avoid having the kernel setting the PSH flag on every TCP packet (among other issues).
- \* modules/\*/\*/\*: Reflected changes from elsewhere.
- \* scripts/common/vmware-user.desktop: add missing "Type" information; fixes auto-start of vmware-user on Ubuntu 8.10.
- \* toolbox/\*: fix a GTK+ warning caused when trying to unref a dialog instance from a signal callback.
- \* vmware-user/copyPaste.c: work around an issue when OpenOffice's "cut" command is used; it sets the timestamp of both the clipboard and the primary selection, but only puts data in the clipboard.
- \* Other files: minor refactorings, and changes unrelated to open-vm-tools.

2008-10-13 Adar Dembo <adar@vmware.com>

- \* Resync with internal trunk (2008.10.09)
- \* configure.ac, modules/Makefile.am: Added a command-line option to skip privileged operations during make install (requested by Dennis Leroy). Integrated new vmxnet3 kernel module.
- \* configure.ac, lib/guestInfo/Makefile.am, lib/guestInfo/guestInfoPerfMonLinux.c, lib/include/vm\_procps.h: Removed open-vm-tools dependency on libproc-dev by providing some procps bits and pieces in our own vm\_procps.h (Sourceforge bug 1960947).
- \* hgfsmounter/Makefile.am: Removed chown calls. Only call chmod if we're running as root (requested by Dennis Leroy).
- \* \*/foreignVMTToolsDaemon.c, \*/foundryToolsDaemon.[ch], lib/guestInfo/guestInfo.c, lib/guestInfo/guestInfoServer.c, lib/include/guestInfoServer.h, lib/include/vixTools.h, lib/rpcin/rpcin.c, lib/vixTools/vixTools.c, vmware-user/copyPaste.c, vmware-user/vmware-user.c: More refactoring from the Tools core services project.
- \* \*/foundryToolsDaemon.c: Changed HGFS mounting behavior such that the

global HGFS share is mounted at /mnt/hgfs instead of relying on "mount -a".

\* guestd/toolsDaemon.[ch], lib/include/backdoor\_def.h, lib/include/system.h, lib/include/vm\_app.h, lib/system/systemLinux.c: Added backwards time synchronization functionality. Moved Tools scripts checking from VMX to guestd.

\* hgfsmounter/hgfsmounter.c: Added handling for multiple "-o" flags on the command line.

\* lib/dynxdr/dynxdr.c: Fixed x\_putint32 behavior on 64-bit Solaris.

\* lib/file/\*, lib/include/codeset.h, lib/include/file.h, lib/include/fileIO.h, lib/include/hostinfo.h, lib/include/loglevel\_user.h, lib/include/productState.h, lib/include/timeutil.h, lib/include/unicodeTypes.h, lib/include/vixCommands.h, lib/include/vix.h, lib/include/vm\_basic\_asm.h, lib/include/vm\_basic\_types.h, lib/include/vm\_legal.h, lib/include/vm\_product.h, lib/include/win32util.h, lib/include/x86cpuid.h, lib/misc/codeset.c, lib/misc/codesetOld.[ch], lib/misc/posixPosix.c, lib/misc/timeutil.c, lib/region/region.c, lib/string/bsd\_vsnprintf.c, lib/unicode/\*, lib/user/hostinfoPosix.c, modules/freebsd/vmhgfs/sha1.c, modules/\*/\*vm\_device\_version.h, modules/linux/\*vmci\_iocontrols.h, modules/linux/\*vmci\_version.h, modules/linux/vmhgfs/hgfsEscape.h: Changes from work unrelated to open-vm-tools on internal trunk.

\* lib/ghIntegration/ghIntegrationX11.c: Fixed some bugs in menu-spec and desktop-entry-spec support in Linux guests.

\* lib/guestApp/guestApp.c, lib/include/guestApp.h, lib/include/statelogger\_backdoor\_def.h, toolbox/Makefile.am, toolbox/toolbox-cmd.c, toolbox/toolbox-gtk.c, toolbox/toolboxCmdInt.h, toolbox/toolboxGtkInt.h, toolbox/toolboxInt.h, toolbox/toolboxRecord.c, toolbox/toolboxcmd-record.c: Patches from Yiwen Zhang to add basic record/replay controls to the gtk and command-line toolbox apps.

\* lib/guestInfo/guestInfoPosix.c: Fixed a bug where we assumed the primary interface's addresses were all IPv4 addresses.

\* lib/guestInfo/guestInfoServer.c: Fixed a memory leak.

\* lib/guestRpc/Makefile.am, lib/guestRpc/unityActive.x, lib/include/guestCaps.h, lib/include/unityCommon.h, lib/unity/unity.c, vmware-user/Makefile.am: Added new unityActive xdr protocol, used for

tracking whether Unity is enabled or not.

\* lib/hgfsServer/hgfsServer.c, lib/hgfsServer/hgfsServerLinux.c,  
lib/hgfsServerPolicyGuest/hgfsServerPolicyGuest.c,  
lib/include/hgfsProto.h:  
Fixed bug where we were invalidating HGFS  
handles on the share of entire drive ("/"). Added optional symlink  
following behavior to HGFS server. Fixed a UTF-8 validation issue.  
Added volume ID field to attribute fields.

\* lib/include/vm\_tools\_version.h: Bumped internal Tools backdoor  
version.

\* lib/include/vm\_version.h: Bumped TOOLS\_VERSION.

\* lib/procMgr/progMgrPosix.c: Fixed impersonation behavior so that  
uids are passed to setresuid instead of gids. Added alternate way to  
list processes in situations where a process lacks a command line.

\* lib/region/region.c: Reforked xorg miregion.c and apply open-vm-tools  
specific patches.

\* lib/unity/\*, lib/unityWindowTracker/unityWindowTracker.c: Fixed an  
overflow that lead to a panic when a window title exceeded 1024 bytes.  
Fixed some initialization assumptions when using virtual desktops.

\* lib/unity/unityPlatformX11Window.c:  
Fixed an issue with restacking  
windows above non-existent windows. Other minor fixes.

\* modules/\*/\*/\*: Reflected changes from elsewhere.

\* modules/linux/\*/Makefile.kernel: Changed clean target to remove  
Module.markers and modules.order.

\* modules/linux/vsock/include/compat\_sock.h,  
modules/linux/vsock/\*: Fixed several issues in vsock.

2008-09-03 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.08.29)

\* Makefile.am, aclocal.m4, m4/\*: Moved macros to 'm4' subdir.

\* compile, config.guess, config.sub, config/\*, depcomp, install-sh,  
ltmain.sh, missing: Moved auxiliary build tools to 'config' subdir.

\* configure.ac: Moved macros and auxiliary build tools into separate  
subdirectories. Added command line option to force the use of gtk1 over

gtk2. Cosmetic fixes. Reworked libicu detection. Switched over to libtool-2.2. Added library check for new gdk symbol. Added library check for libnotify. Reworked use of macros from AC\_PATH\_XTRA and some X11 library checks.

\* \*/foundryToolsDaemon.c, toolbox/toolbox-cmd.c, guestd/main.c, lib/guestInfo/guestInfoPerfMonLinux.c, lib/guestInfo/guestInfoPosix.c, lib/misc/posixPosix.c, lib/panic/panic.c, lib/system/systemLinux.c, modules/linux/vsock/linux/util.c, xferlogs/xferlogs.c: Added checks for return codes of certain functions and passed %s to formatted string functions where appropriate (needed to compile on Ubuntu Intrepid).

\* lib/appUtil/appUtilX11.c: Fixed command line skipping logic and added more icon paths. Removed unnecessary chdir(2) canonicalization logic.

\* lib/deployPkg/runDeployPkgPosix.c, lib/file/fileIO.c, lib/file/fileIOPosix.c, lib/file/fileLockPrimitive.c, lib/file/filePosix.c, lib/hgfsServer/hgfsServerLinux.c, lib/include/bsdfmt.h, lib/include/file.h, lib/include/fileIO.h, lib/include/iovector.h, lib/include/msgfmt.h, lib/include/str.h, lib/include/vm\_basic\_defs.h, lib/include/vm\_basic\_types.h, lib/misc/hostname.c, lib/misc/idLinux.c, lib/misc/posixPosix.c, lib/SLPv2Parser/\*.\*.c, lib/wiper/wiperPosix.c, toolbox/toolboxScripts.c: Added FreeBSD compatibility glue.

\* guestd/toolsDaemon.c, lib/file/file.c, lib/foundryMsg/foundryPropertyListCommon.c, lib/image/imageUtilPng.c, lib/include/appUtil.h, lib/include/backdoor\_def.h, lib/include/conf.h, lib/include/cpuid\_info.h, lib/include/guest\_os.h, lib/include/hostinfo.h, lib/include/imageUtil.h, lib/include/imageUtilTypes.h, lib/include/log.h, lib/include/loglevel\_user.h, lib/include/netutil.h, lib/include/posix.h, lib/include/timeutil.h, lib/include/util.h, lib/include/uuid.h, lib/include/vix.h, lib/include/vixOpenSource.h, lib/include/vm\_atomic.h, lib/include/vm\_legal.h, lib/include/vm\_version.h, lib/include/x86cpuid.h, lib/misc/codesetOld.c, lib/misc/timeutil.c, lib/string/bsd\_vsnprintf.c, lib/user/util.c, lib/user/utilPosix.c, lib/vixTools/vixTools.c, modules/linux/\*/vmci\_kernel\_if.h, modules/linux/vmxnet/compat\_timer.h, toolbox/toolboxCmdInt.h, toolbox/toolboxcmd-\*.c:

Changes

from work unrelated to open-vm-tools on internal trunk.

\* lib/ghIntegration/ghIntegration.c, lib/guestRpc/ghiGetBinaryHandlers.x: Don't send oversized messages. Increased maximum number of binary handlers.



- \* lib/ghIntegration/ghIntegrationX11.c, lib/guestApp/guestAppPosix.c, lib/include/guestApp.h, lib/include/system.h, lib/system/systemLinux.c, toolbox/toolbox-gtk.c: Improved "run program" functionality by restoring program environment and stripping any VMware wrapper script changes to LD\_LIBRARY\_PATH.
- \* lib/guestApp/guestAppPosixX11.c: Now using glib to open URLs instead of system(3). Improved gnome and kde session detection.
- \* lib/guestApp/Makefile.am: This library needed GTK\_CPPFLAGS too.
- \* lib/guestInfo/guestInfoInt.h, lib/guestInfo/guestInfoPosix.c, lib/guestInfo/guestInfoServer.c: Added logic to optionally convert subnet mask to an ASCII string.
- \* lib/guestRpc/Makefile.am: Cleaned up generated xdr headers better.
- \* lib/hgfsServer/hgfsServer.c, lib/hgfsServer/hgfsServerInt.h, lib/hgfsServer/hgfsServerLinux.c: Fixed problems when packing V3 replies.
- \* lib/hgfsServer/hgfsServerLinux.c: Fixed UTF-8 normal form D/C conversions on the root directory.
- \* lib/include/dndGuest.h: Changed preprocessor usage to allow gtk1 to access UnityDnD.
- \* lib/include/dnd.h, vmware-user/copyPaste.c: Code motion.
- \* lib/include/guestCaps.h: Resort the capabilities table.
- \* lib/include/rpcin.h, lib/rpcIn/rpcin.c, : Beginnings of the Tools core services. This is a full-fledged refactoring of the Tools userlevel apps to a "service" vs. "plugin" programming model.
- \* lib/include/vmblock.h, modules/\*/vmblock/block.c, modules/\*/vmblock/stubs.c, modules/\*/vmblock/stubs.h: Changes needed to support the fuse-based implementation of vmblock (coming soon).
- \* lib/include/vm\_tools\_version.h: Some Tools version bumps.
- \* modules/\*/\*/\*: Reflected changes from elsewhere.
- \* modules/\*/\*/compat/compat\_stdarg.h: Added compatibility wrappers for stdarg

features.

\* modules/freebsd/vmhgfs/debug.\*: Cosmetic fixes.

\* modules/freebsd/vmhgfs/\*: Make driver compliant with HGFSv3.

\* modules/\*/vmmemctl/vmballoon.c: Allow module to yield the processor when allocating many pages.

\* modules/linux/\*/autoconf/cachector1.c,  
modules/linux/\*/include/compat\_sched.h,  
modules/linux/\*/include/compat\_semaphore.h,  
modules/linux/\*/include/compat\_slab.h,  
modules/linux/vmblock/linux/filesystem.c,  
modules/linux/\*/Makefile.kernel,  
modules/linux/vmhgfs/bdhandler.c, modules/linux/vmhgfs/filesystem.c,  
modules/linux/vmhgfs/module.h, modules/linux/vmhgfs/request.c,  
modules/linux/vmsync/sync.c, modules/linux/vsock/linux/af\_vsock.c: Fix modules for 2.6.27 kernels.

\* modules/linux/\*/Makefile: Fixed DRIVER target.

\* modules/linux/vmci/vmci\_drv.c: Moved interrupt registration to be after driver initialization.

\* modules/linux/vsock/linux/af\_vsock.c,  
modules/linux/vsock/linux/af\_vsock.c: Added optimized flow control protocol.

\* toolbox/toolboxScripts.c,  
toolbox/toolboxShrink.c: Cosmetic fixes.

\* vmware-user/copyPaste.c, vmware-user/dnd.c: Fixed edge case behavior with file copy paste and DnD.

\* vmware-user/modconfig.c, vmware-user/notify.c,  
vmware-user/vmware-user.c, vmware-user/vmwareuserInt.h: Added stubbed modconfig module out-of-date notification framework. Not useful for open-vm-tools, hence the stubs.

2008-08-08 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.07.24)

\* configure.ac, \*/Makefile.am: Landed support for command line Toolbox, Unity, vsock, and vmci. Refactored and reformatted a few things. Improved portability by using \$(SED) and AC\_PROG\_SED instead of "sed", \$(MKDIR\_P) and AC\_PROG\_MKDIR\_P instead of "mkdir -p", \$(LN\_S) and AC\_PROG\_LN\_S instead of "ln -s". Changed icu feature detection and

linking to rely on C++ linker instead of C linker. Fixed module compilation checks on FreeBSD. Fixed \$(DESTDIR) handling (patch by Mike Auty). Refactored lib/strUtil into lib/misc.

Changed hgfsmounter

install hook to symlink mount.vmhgfs. Renamed libghIntegrationStub to libGhIntegrationStub. Fixed compilation of lib/guestApp when using --without-x (reported by Martin Preishuber). Renamed libunityStub to libUnityStub. Fix build on FreeBSD by using ":" instead of "=" when exporting module directories. The vmware-user desktop link now executes vmware-user-suid-wrapper. Properly install vmware-user-suid-wrapper.

\* \*/foundryToolsDaemon.c, lib/vixTools/vixTools.c: Use a larger result packet when handling impersonated HGFS requests (since HGFSv3 uses larger packets).

\* guestd/main.c: Moved foreign VM check.

\* guestd/toolsDaemon.\*: Added plumbing for HGFS usability library calls.

\* hgfsmounter/hgfsmounter.c: Added support for passing options to the MacOS HGFS driver.

\* lib/appUtil/\*, lib/include/appUtil.h: New library for Unity support.

\* lib/auth/authPosix.c: Don't try using PAM from the Tools.

\* lib/dnd/dndCommon.c, lib/dnd/dndLinux.c, lib/file/file.c, lib/file/fileIOPosix.c, lib/file/filePosix.c, lib/include/dnd.h, lib/include/loglevel\_user.h, lib/include/panic.h, lib/include/posix.h, lib/include/strutil.h, lib/unicode/unicodeBase.h, lib/include/unicodeOperations.h, lib/include/vix.h, lib/include/vm\_app.h, lib/include/vm\_assert.h, lib/include/vm\_product.h, lib/include/x86cpuid.h, lib/misc/codeset.c, lib/misc/hashTable.c, lib/misc/strutil.c, lib/misc/timeutil.c, lib/panic/panic.c, lib/string/bsd\_vsnprintf.c, lib/strUtil/\*, lib/unicode/unicodeCommon.c, lib/unicode/unicodeSimpleBase.c, lib/unicode/unicodeStatic.c, lib/user/hostinfoPosix.c, lib/user/util.c, lib/user/utilPosix.c: Changes from work unrelated to open-vm-tools on the internal trunk.

\* lib/backdoor/backdoorInt.h, lib/deployPkg/runDeployPkgInt.h, lib/dnd/dndInt.h, lib/file/fileInt.h, lib/guestInfo/guestInfoInt.h, lib/hgfs/cpNameInt.h, lib/hgfsServer/hgfsServerInt.h, lib/impersonate/impersonateInt.h, lib/include/backdoorInt.h, lib/include/bsd\_output\_int.h,

lib/include/cpNameInt.h,  
lib/include/dndInt.h, lib/include/fileInt.h,  
lib/include/guestInfoInt.h, lib/hgfsServer/hgfsServerInt.h,  
lib/include/impersonateInt.h, lib/include/runDeployPkgInt.h,  
lib/include/toolsLoggerInt.h, lib/include/unicodeInt.h,  
lib/string/bsd\_output\_int.h, lib/toolsLogger/toolsLoggerInt.h,  
lib/unicode/unicodeInt.h: Moved some internal header files out of  
the general include directory and into the appropriate libraries.

\* lib/ghIntegration/\*: New library for Unity support.

\* lib/guestApp/guestAppPosixX11.c: Reset the value of LD\_LIBRARY\_PATH  
before running the web browser.

\* lib/guestInfo/guestInfoPosix.c, lib/include/guest\_os.h: Fixed a typo  
in Mandriva guest detection. Added Asianux.

\* lib/guestInfo/guestInfoServer.c: Fixed behavior for sending nicInfo  
updates to the host (patch by Jason Lunz).

\* lib/guestRpc/ghi\*.\*: New xdr protocol for Unity support.

\* lib/guestRpc/nicinfo.x: Correctly applied LGPL to file.

\* lib/hgfs/cpNameLinux.c:  
Allow building for versions of Solaris newer  
than 10.

\* lib/hgfsServer/hgfsServer.c,  
lib/hgfsServerPolicyGuest/hgfsServerPolicyGuest.c,  
lib/include/hgfsServerPolicy.h: Provide an override setting for  
disabling case conversion during file lookups.

\* lib/hgfsServer/hgfsServerLinux.c: Only perform case insensitive  
file lookups if a case sensitive lookup fails.

\* lib/image/imageUtilPng.c, lib/include/imageUtil.h,  
lib/include/imageUtilTypes.h: New library for  
Unity support.

\* lib/include/conf.h, toolbox/toolbox-gtk.c: Robustified the help page  
discovery mechanism.

\* lib/include/dndGuest.h: Allow inclusion of header into source files  
without GTK2 support.

\* lib/unity/\*, lib/include/guestCaps.h, lib/include/unityCommon.h: New  
library for Unity support.

- \* lib/include/hgfsUtil.h: Fixed a precedence issue in a macro.
- \* lib/raster/\*, lib/include/rasterConv.h: New library for Unity support.
- \* lib/region/\*, lib/include/region.h: New library for Unity support.
- \* lib/include/system.h:  
Added new OS type for WinXP 64-bit, reformatted  
enums.
- \* lib/unityWindowTracker/\*, lib/include/unityWindowTracker.h: New  
library for Unity support.
- \* lib/include/vm\_version.h: Bumped TOOLS\_VERSION.
- \* lib/wiper/wiperPosix.c: Replaced BSD\_VERSION with \_\_FreeBSD\_version.
- \* modules/\*/\*/\*: Reflected changes from elsewhere.
- \* modules/freebsd/vmhgfs/\*: Reflected changes from MacOS HGFS work, and  
fixed file permissions so that they're not all owned by root.
- \* modules/linux/vmblock/linux/dentry.c: Changed d\_revalidate to  
properly invalidate negative dentries.
- \* modules/linux/vmci/\*: Landed the Virtual Machine Communication  
Interface guest module.
- \* modules/linux/vmmemctl/os.c: Fixed vmmemctl to build on 2.6.26  
(reported by Pavol Rusnak).
- \* modules/linux/vmsync/sync.c: Fixed vmsync to build on 2.6.26  
(reported by Pavol Rusnak).
- \* modules/linux/vsock/\*: Landed the VMCI sockets interface module.
- \* modules/linux/vmxnet/vmxnet.c, modules/linux/vmxnet/vmxnet2\_def.h,  
modules/linux/vmxnet/vmxnetInt.h:  
Increased rx ring size for enhanced  
vmxnet2.
- \* toolbox/\*: Refactored pieces of GTK Toolbox and landed the command  
line Toolbox. Fixed mnemonic collisions in the GTK Toolbox.
- \* vmware-user/copyPaste.c: Fixed several bugs with file copy paste  
behavior.

\* vmware-user/notify.c, vmware-user/vmware-user.c,  
vmware-user/vmwareuserInt.h: Added stubs for notification framework.

\* vmware-user/pointer.c: Reverted fix for bug with clipboard retry  
behavior.

\* vmware-user/vmware-user.c: Fixed build with gtk 1.2 (reported by  
Stephen Duncan). Added signal handlers for SIGUSR1/SIGUSR2 used by  
VMware Tools installer to reload vmware-user cleanly during a Tools  
upgrader. Reload vmware-user on a fatal X I/O error. Don't panic if  
run outside of a VM. Don't leave Unity mode on a Tools reset.

2008-07-01 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.06.30)

\* configure.ac, lib/guestApp/\*, toolbox/Makefile.am,  
vmware-user/Makefile.am:

Split lib/guestApp into two libraries, one  
with X11 functionality, and one without. Improved detection of  
gnome-open.

\* guestd/\*, lib/netUtil/netUtilLinux.c: guestd now compiles for MacOS  
guests.

\* guestd/main.c, lib/include/system.h, lib/system/systemLinux.c:  
Refactored GuestdWritePidfile into System\_Daemon.

\* guestd/toolsDaemon.c: Fixed a backwards time synchronization issue.  
Thanks to Eric Castan for reporting the bug.

\* lib/conf/conf.c, lib/include/conf.h: Removed obsolete configuration  
keys and values.

\* lib/file/\*, lib/dict/\*, lib/foundryMsg/\*, lib/include/backdoor\_def.h,  
lib/include/codeset.h, lib/include/config.h,  
lib/include/file\_extensions.h, lib/include/fileInt.h,  
lib/include/loglevel\_user.h, lib/include/msg.h, lib/include/msgid.h,  
lib/include/posix.h, lib/include/preference.h, lib/include/unity.h,  
lib/include/vixCommands.h, lib/include/vix.h,  
lib/include/vmbackup\_def.h, lib/include/vmBackup.h,  
lib/include/vm\_basic\_defs.h, lib/include/vm\_basic\_types.h,  
lib/include/vm\_product.h,  
lib/include/win32util.h,  
lib/include/x86cpuid.h, lib/misc/codeset.c, lib/misc/codesetOld.c,  
lib/misc/codesetOld.h, lib/misc/posixPosix.c, lib/strUtil/strutil.c,  
lib/user/hostinfoPosix.c, lib/user/util.c,  
lib/vmBackupLib/stateMachine.c, modules/\*/vmxnet/net.h: Changes from  
work unrelated to open-vm-tools on the internal trunk.

- \* lib/guestRpc/Makefile.am: Added comment about misuse of CFLAGS.
- \* lib/hgfsServer/hgfsServer.c: Corrected pointer arithmetic so that new node and search allocation works consistently in 64-bit apps.
- \* lib/hgfsServer/hgfsServerLinux.c, lib/include/hgfsProto.h: Added HGFS\_ATTR\_HIDDEN\_FORCED and set it when returning hidden files.
- \* lib/hgfsServer/\*, lib/hgfsServerPolicy/hgfsServerPolicyGuest.c, lib/include/hgfsServerInt.h, lib/include/hgfsServerPolicy.h: Refactored and cleaned up some code.
- \* lib/include/resolution.h, lib/resolution/\*, vmware-user/vmware-user.c: Refactored some functions.
- \* lib/include/vm\_legal.h: Added another patent to the patent string.
- \* lib/include/vm\_tools\_version.h: Added a pair of Tools version macros.
- \* lib/include/vm\_version.h: Bumped Tools product version.
- \* lib/Makefile.am: Included a fix for compilation --without-x. Thanks to Mark Foster for reporting the issue.
- \* lib/misc/Makefile.am, lib/misc/shared/Makefile.am: Realphabetized some sources and added missing source files.
- \* lib/misc/posixWin32.c: Removed unneeded file from tree.
- \* lib/procMgr/procMgrPosix.c: Made safe for -fPIC and for MacOS.
- \* modules/\*/\*/\*: Reflected changes from elsewhere.
- \* modules/freebsd/vmhgfs/\*: Added some code to handle codeset conversions between UTF-8 precomposed and decomposed strings.
- \* modules/linux/vmhgfs/\*: Refactored string escaping/unescaping code.
- \* toolbox/\*: Added mnemonics for some buttons.
- \* vmware-user/pointer.c: Fixed bug in clipboard retry behavior.
- \* vmware-user/vmware-user.c: Added handlers for SIGUSR1 and SIGUSR2 to facilitate smooth vmware-user upgrades with respect to the vmblock kernel module.

2008-06-20 Elliot Lee <elliott@vmware.com>

\* Resync with internal trunk (2008.06.13)

\* FreeBSD 7/8 fixes from Martin Blapp.

\* Fix getpwnam\_r etc. on FreeBSD & Solaris.

\* configure.ac: Add --without-kernel-modules,  
--with-linux-release, and --with-linuxdir (gissa).

\* configure.ac, lib/guestRpc/\*, lib/guestInfo/guestInfo.c,  
lib/guestInfo/guestInfoServer.c, lib/dynxdr/\*,  
{vmware-user,guestd}/foreignVMToolsNetworking.c, guestd/Makefile.am,  
{vmware-user,guestd}/foundryToolsDaemon.c, lib/include/dynxdr.h,  
lib/include/guestInfo.h, lib/include/vmxrpc.h,  
lib/include/xdrutil.h, lib/Makefile.am, lib/netUtil/\*,  
lib/vixTools/Makefile.am: Add support for XDR encoding of RPC  
values, including the NicInfoV2 structure.

\* guestd/stub.c, hgfsclient/Makefile.am, hgfsclient/stub.c,  
hgfsclient/stub-user-util.c, hgfsmounter/Makefile.am,  
hgfsmounter/stub.c, lib/stubs/\*, libguestlib/Makefile.am,  
libguestlib/stubs.c,  
toolbox/Makefile.am, toolbox/stub.c,  
vmware-user/stub.c: Centralize stubs.

\* lib/guestInfo/guestInfoPerfMonLinux.c: Convert ioInRate and  
ioOutRate to be in terms of KB instead of pages.

\* lib/hgfsBd/hgfsBd.c, lib/hgfsServer/hgfsServer.c,  
lib/hgfsServer/hgfsServerLinux.c: Large packet support, and  
additional case-insensitivity fixes.

\* lib/include/hgfsBd.h, lib/include/hgfs.h,  
lib/include/hgfsProto.h: Add HGFS error code.

\* lib/hgfs/hgfsUtil.c, lib/guestInfo/Makefile.am,  
lib/guestInfo/guestInfoPosix.c, lib/guestApp/guestApp.c,  
lib/foundryMsg/foundryMsg.c, lib/file/fileLockPrimitive.c,  
lib/file/fileIOPosix.c, lib/file/fileLockPosix.c,  
guestd/toolsDaemon.c, guestd/debugStdio.c, guestd/main.c,  
lib/hgfsServerManagerGuest/hgfsServerManagerGuest.c,  
lib/include/codeset.h, lib/include/cpuid\_info.h,  
lib/include/dnd.h, lib/include/file\_extensions.h,  
lib/include/fileInt.h, lib/include/ghIntegration.h,  
lib/include/guestApp.h, lib/include/guestStats.h,



lib/include/hgfsServerInt.h,  
lib/include/hgfsUtil.h,  
lib/include/hostinfo.h, lib/include/loglevel\_user.h,  
lib/include/netutil.h, lib/include/panic.h, lib/include/posix.h,  
lib/include/unicode\*.h, lib/include/util.h, lib/include/vix.h,  
lib/include/vixTools.h, lib/include/vm\_app.h,  
lib/include/vm\_basic\_defs.h, lib/include/vm\_product.h,  
lib/include/vm\_tools\_version.h, lib/include/vm\_version.h,  
lib/include/x86cpuid.h, lib/misc/codeset.c, lib/misc/codesetOld.c,  
lib/misc/codesetOld.h, lib/misc/hashTable.c, lib/misc/hostname.c,  
lib/misc/timeutil.c, lib/panic/panic.c, lib/string/str.c,  
lib/sync/syncMutex.c, lib/system/systemLinux.c, lib/unicode/\*.c,  
lib/unityStub/\*, lib/user/hostinfo.c, lib/user/hostinfoPosix.c,  
lib/vixTools/\*, modules/linux/vmxnet/\*, toolbox/debugStdio.c,  
vmware-user/debugStdio.c, vmware-user/dnd.c, vmware-user/main.c:  
Bug fixes.

\* modules/linux/vmxnet/\*: Remove unused BPF code. Add ethtool  
callbacks to get & set driver settings.

\* lib/user/util.c: Add function for getting backtraces.

\*

lib/resolution/\*, vmware-user/\*, lib/Makefile.am, configure.ac:  
Move resolution-changing code into separate library.

\* guestd/main.c, lib/include/tools.h: Allow disabling tools  
version reporting to the host, via config file.

\* lib/rpcIn/\*, lib/include/rpcin.h, guestd/toolsDaemon.c,  
toolbox/toolbox-gtk.c: Updated RPC API

\* lib/include/dndGuest.h: Helper API for DnD code

\* modules/freebsd/vmhgfs/\*, modules/freebsd/vmmemctl/\*,  
modules/freebsd/vmblock/\*, modules/linux/vmhgfs/\*,  
modules/linux/vmmemctl/\*: Reflect changes from main source tree.

\* vmware-user/copyPaste.c: Copy/paste cleanup.

\* vmware-user/vmware-user.c: Updated locking code to use X11  
display instead of lockfiles.

2008-06-03 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.05.28).

\* configure.ac, Makefile.am, \*/Makefile.am: Added rudimentary  
`make install` support. Fixes Sourceforge bug 1839981.

\* configure.ac, Makefile.am, vmware-user-suid-wrapper/\*: Added vmware-user-suid-wrapper to help autostart vmware-user. Added some informational tags to AC\_DEFINE macros.

\* \*/debugStdio.c: Fixed a format string vulnerability in Debug. Allocate fd on the stack in DebugToFile.

\* lib/auth/authPosix.c, lib/dnd/dndCommon.c, lib/dnd/dndLinux.c lib/impersonate/impersonate.c: Add inclusion of vmware.h and refactor some include statements.

\* lib/file/file.c, lib/include/file.h: Added File\_UnlinkNoFollow function.

\* lib/file/fileIO.c, lib/file/fileLockPrimitive.c, lib/include/fileIO.h: Added error case for ENAMETOOLONG to FileIO\_Lock. Constified 'buf' in FileIO\_Pwrite.

\* lib/file/fileIOPosix.c: Removed coalescing and decoalescing code. Consolidated some Unicode calls.

\* lib/file/filePosix.c: Reworked some error handling logic.

\* lib/foundryMsg/foundryMsg.c: Refactored buffer encoding and decoding logic into a single pair of functions.

\* lib/foundryMsg/foundryThreads.c, lib/include/foundryThreads.h lib/include/util.h, lib/misc/util\_misc.c: Changed generic thread type from uintptr\_t to Util\_ThreadID.

\* lib/hgfsServer/\*, lib/hgfs/hgfsProto.h, modules/linux/vmhgfs/\*: Additional HGFSv3 fixes and refactoring.

\* lib/include/dblInkLst.h, lib/misc/dblInkLst.c: Constified argument to DbLInkLst\_IsLinked.

\* lib/include/dnd.h: Added support for DnD of RTF.

\* lib/include/fileInt.h: Removed prototype of FileLockFileSize.

\* lib/include/hashTable.h, lib/misc/hashTable.c: Cosmetic changes. Added HashTable\_ReplaceIfEqual.

\* lib/include/loglevel\_user.h: Added hpet loglevel.

- \* lib/include/msg.h: Removed prototype of MsgSetPostStderrBlock.
- \* lib/include/posix.h: Removed certain includeCheck allowances.
- \* lib/include/productState.h: Added VDM client product.
- \* lib/include/unicode\*, lib/unicode/\*: Ongoing i18n work.
- \* lib/include/vixCommands.h: Added command to set snapshot information.
- \* lib/include/vix.h: Added more errors and a new flag.
- \* lib/include/vixOpenSource.h: Reworked asserts and added VIX\_ASSERT.
- \* lib/include/vm\_app.h:  
Added Tools tray app.
- \* lib/include/vm\_product.h: Reworked VMRC product definitions and added VDM client product definitions.
- \* lib/include/vm\_tools\_version.h: Added WS65 Tools version.
- \* lib/include/vm\_version.h: Bumped Tools version. Added logic for VMRC product.
- \* lib/include/x86cpuid.h: Modified a flag and trimmed an unneeded macro.
- \* lib/misc/codesetOld.c: Implement UTF-16 codest conversion to UTF-8 for CURRENT\_IS\_UTF8.
- \* lib/misc/dynbuf.c: Modified dynbuf growing behavior.
- \* lib/misc/posixDlopen.c, lib/misc/posixInt.h, lib/misc/posixPosix.h:  
Refactored codeset conversion code into PosixConvertToCurrent.
- \* lib/misc/posixWin32.c: Added some path checks.
- \* lib/misc/timeutil.c: Win32-wrappified TimeUtil\_GetTimeFormat.
- \* lib/misc/vmstdio.c: Reduce virtual memory usage and add '\r' as a line ending in StdIO\_ReadNextLine.
- \* lib/rpcout/rpcout.c: Added comments.
- \* lib/str/str.c: Cosmetic changes.
- \* lib/vixTools/vixTools.c: Added unlink(2) logic

to avoid deleting  
symlink targets. Cosmetic changes.

\* modules/\*/\*/\*: Reflect changes from elsewhere in the source tree.

\* modules/linux/vmhgfs/super.c: Fix vmhgfs to properly report the available space on the host (Sourceforge bug 1924246).

\* vmware-user/vmware-user.c: Add advisory locking code to help maintain only one vmware-user instance per X session.

\* xferlogs/xferlogs.c: Fix a formatted string vulnerability.

2008-05-12 Elliot Lee <elliott@vmware.com>

\* Resync with internal trunk (2008.05.08).

\* configure.ac, \*\*/Makefile.am: Use CPPFLAGS instead of CFLAGS to eliminate warning about proc/sysinfo.h.

\* guestd/foreignVMToolsNetworking.c,  
vmware-user/foreignVMToolsNetworking.c  
lib/hgfsServer/hgfsServerLinux.c, lib/include/hgfsServerInt.h,  
modules/linux/vmhgfs/bdhandler.c, modules/linux/vmhgfs/dir.c,  
modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/filesystem.h,  
modules/linux/vmhgfs/fsutil.h, modules/linux/vmhgfs/inode.c,  
modules/linux/vmhgfs/link.c, modules/linux/vmhgfs/module.h,  
modules/linux/vmhgfs/page.c,  
modules/linux/vmhgfs/request.c,  
modules/linux/vmhgfs/request.h: Whitespace cleanups.

\* guestd/main.c: Removed "blessed app" code for starting vmware-user. Hooray!

\* lib/deployPkg/deployPkg.c: Remove unneeded Utf8 conversion for Windows.

\* lib/file/filePosix.c: Use new Posix\_RealPath implementation.

\* lib/guestApp/guestApp.c, lib/include/guestApp.h: Remove/cleanup UTF-8 related RPC functions.

\* lib/guestInfo/guestInfoPerfMonLinux.c,  
lib/guestInfo/guestInfoPosix.c, lib/include/guestInfo.h,  
lib/include/guestInfoInt.h, lib/include/guestStats.h: Rename structures to GuestMemInfo, GuestNicInfo, and GuestDiskInfo.

\* lib/guestInfo/guestInfoServer.c, lib/include/guest\_msg\_def.h: As

above, and also GUESTMSG\_MAX\_IN\_SIZE moved to guest\_msg\_def.h, and misc locking updates. Also add GuestInfoServer\_Main(), and cleanup whitespace.

\* lib/hgfsServer/hgfsServer.c: Cleanup UTF-8 handling.

\* lib/include/codeset.h: Update defines that indicate whether the current platform is using UTF-8.

\* lib/include/dnd.h: Add prototypes for a couple of string conversion functions.

\* lib/include/file\_extensions.h: Add OVF and Archived OVF file extensions.

\* lib/include/file.h: C++ guard thingies. Update a couple of function prototypes to work on file descriptors instead of filenames.

\* lib/include/hashTable.h, lib/include/guest\_os.h, lib/include/loglevel\_defs.h, lib/include/stats\_user\_defs.h, lib/include/stats\_user\_setup.h, lib/include/str.h, lib/include/unicodeTypes.h, lib/include/util.h: Allow inclusion in kernel modules...

\* lib/include/loglevel\_user.h: As above, and add a couple of loglevel variables.

\* lib/include/util.h, lib/misc/util\_misc.c: Allow inclusion in kernel modules as above, and add some utility functions on Windows for manipulating canonical paths.

\* lib/include/hgfsProto.h, lib/include/hgfsUtil.h: Move request/reply payload macros to hgfsProto.h.

\* lib/include/hgfsServerPolicy.h: Add ShareList management prototypes and structure members.

\* lib/include/msg.h: Add function prototypes for creating and posting lists of messages.

\* lib/include/system.h: Add types & functions related to desktop switch monitoring on Windows.

\* lib/include/unicodeOperations.h: Add/update inline unicode operations.

\* lib/include/vixCommands.h: Add VIX requests and events.

- \* lib/include/vmbackup\_def.h, lib/vmBackupLib/stateMachine.c: Move backup status enum to public header.
- \* lib/include/vm\_basic\_asm\_x86\_64.h: Div643232 now also works on MSC.
- \* lib/include/vm\_basic\_defs.h: Add debug output macros for Windows drivers.
- \* lib/include/vm\_basic\_types.h: Update the FMTPD macro, add SCANF\_DECL macro for arg checking on scanf-like functions.
- \* lib/include/x86cpuid.h: Defines for AMD L2/L3 cache separately, and CPUID for Nehalem.
- \* lib/misc/codesetOld.c: Bug fixes and general unicode handling updates.
- \* lib/system/systemLinux.c: Use Posix\_Getenv/Posix\_Setenv impls.
- \*
- lib/vixTools/vixTools.c, lib/vmBackupLib/scriptOps.c: Bug fixes.
- \* modules/freebsd/\*, modules/linux/\*: Updates to correspond to updates of files in main tree.
- \* modules/freebsd/vmhgfs/hgfs\_kernel.h: Bug fixes.
- \* modules/freebsd/vmxnet/vm\_device\_version: Add SCSI\_IDE\_HOSTED\_CHANNEL define, update SCSI\_MAX\_CHANNELS.
- \* modules/freebsd/vmxnet/vmnet.def: Add capabilities for IPv6 checksumming and TSO, and large packet TSO.
- \* lib/include/vmblock.h, modules/linux/vmblock/linux/control.c, modules/linux/vmblock/linux/vmblockInt.h: Use a macro to better abstract the vmblock mount point & device.
- \* vmware-user/vmware-user.c: Add SIGPIPE to the list of signals that vmware-user handles.

2008-05-02 Adar Dembo <adar@vmware.com>

- \* Resync with internal trunk (2008.04.19).
- \* configure.ac, guestd/Makefile.am, hgfsclient/Makefile.am, lib/misc/\*/Makefile.am, lib/string/\*/Makefile.am, toolbox/Makefile.am, vmware-user/Makefile.am, xferlogs/Makefile.am: Added libicu support for codeset conversions. This includes some makefile logic as well as autoconf arguments for controlling libicu behavior at compile-time.

\* \*/foreignVMToolsNetworking.c, lib/vixTools/vixTools.c: Unicode fixes.

\* \*/foundryToolsDaemon.c, lib/foundryMsg/vixTranslateErrOpenSource.c, lib/panic/panic.c, lib/printer/printer.c: Added calls to Win32 Unicode wrappers.

\* guestd/main.c: Cleaned up guestInfo server when guestd shuts down.

\* guestd/toolsDaemon.c, vmware-user/resolution.c: Disabled multi-mon advertisement for Win2k.

\* lib/auth/authPosix.c, lib/dnd/dndLinux.c, lib/file/\*, lib/impersonate/impersonatePosix.c, lib/include/mntinfo.h, lib/sync/syncWaitQPosix.c, lib/user/hostinfoPosix.c, lib/user/util.c, lib/user/utilPosix.c, lib/wiper/wiperPosix.c: Added calls to POSIX Unicode wrappers.

\* lib/file/\*: Replaced calls to string functions with calls to the "safe" family of string functions.

\* lib/dict/dictll.c, lib/include/dictll.h: Detect and tolerate UTF-8 dictionary files that contain the UTF-8 BOM.

\* lib/err/\*, lib/include/err.h, lib/include/msgfmt.h, lib/include/msg.h: Added support for localization of error strings.

\* lib/foundryMsg/foundryThreads.c, lib/include/foundryThreads.h, lib/misc/util\_misc.c: Added opaque type for threads/process IDs.

\* lib/guestInfo/guestInfoServer.c: Removed separate thread context.

\* lib/hgfsServer/\*, lib/include/hgfs\*.h: Additional HGFSv3 cleanup.

\* lib/hgfsServer/hgfsServerLinux.c: Added calls to POSIX Unicode wrappers. Fixed some alias detection code for MacOS.

\* lib/include/backdoor\_def.h: Added backdoor call for debugging events.

\* lib/include/bsdfmt.h, lib/string/bsd\_vsnprintf.c, lib/string/bsd\_vsnprintfw.c: Replaced BSDFmt\_WCSonv with BSDFmt\_WChartoUTF8.

\* lib/include/codeset.h, lib/include/codesetOld.h, lib/misc/codeset.c, lib/misc/codesetOld.c, lib/string/convertutf.h: Implemented libicu-backed codeset layer. When building without libicu, fallback on codesetOld.

- \* lib/include/guestApp.h:  
Added wide versions of dictionary functions.
- \* lib/include/loglevel\_user.h: Added two new loglevels.
- \* lib/include/posix.h, lib/misc/posixPosix.c: Added new POSIX wrappers.
- \* lib/include/str.h: Clarified the use of some functions.
- \* lib/include/syncMutex.h, lib/include/syncWaitQ.h: Removed unneeded macros.
- \* lib/include/unicode\*.h, lib/unicode/\*: Ongoing Unicode work.
- \* lib/include/util.h: Added Util\_FreeStringList, removed Util\_FreeList.
- \* lib/include/uuid.h: Added new UUID creation scheme.
- \* lib/include/vix\*.h: Tweaked some VIX commands, errors, and properties.
- \* lib/include/vmBackup.h, lib/vmBackupLib/scriptOps.c,  
lib/vmBackupLib/stateMachine.c: Moved disabled targets logic from  
library to Windows VSS provider.
- \* lib/include/vm\_basic\_asm\_x86\*.h: Allow emitted FX functions to  
modify main memory as a side effect.
- \* lib/include/vm\_tools\_version.h: Bump Tools version.
- \* lib/include/vm\_version.h: Added several product versions.
- \* modules/linux/vmhgfs/\*:  
Additional cleanup for HGFSv3. Use new kthread  
wrapper when possible. Bump module version.
- \* modules/linux/vmmemctl/\*: Use new kthread wrapper when possible.  
Remove dead delayed work code. Bump module version.
- \* modules/linux/\*/compat\_kthread.c: Added kthread wrapper implementation  
for modules that use kernel threads.
- \* modules/\*/\*/\*: Reflect header file changes from elsewhere in the  
source code tree.
- \* vmware-user/copyPaste.c, vmware-user/pointer.c,  
vmware-user/vmwareuserInt.h: Stop wastefully polling for pointer  
updates if the VMX is new enough.



\* xferlogs/xferlogs.c: Fixed a warning in the call to fwrite.  
(Thanks to Denis Leroy for reporting this bug.)

2008-04-14 Elliot Lee <elliott@vmware.com>

\* Resync with internal trunk (2008.04.01).

\* Fixed legal header on all LGPL-licensed files.

\* vmware-user/resolution.c: Normalize the display topology that comes in from the host, and report 'global\_offset' capability.

\* toolbox/Makefile.am, vmware-user/Makefile.am,  
lib/misc/Makefile.am,  
lib/misc/atomic.c, lib/Makefile.am,  
lib/atomic/\*, hgfsclient/Makefile.am: Move libAtomic stuff into libmisc

\* vmware-user/foundryToolsDaemon.c, lib/vixTools/vixTools.c,  
lib/include/hgfsServerInt.h, guestd/toolsDaemon.c,  
guestd/foundryToolsDaemon.c: Remove WIN9XCOMPAT, and some SOCKET\_MGR code.

\* vmware-user/copyPaste.c: Copy/paste fixes for cross-platform operation.

\* modules/linux/vmxnet/vmnet\_def.h: Add SG\_SPAN\_PAGES capability.

\* modules/linux/vmxnet/vm\_device\_version.h: Update some device limits.

\* modules/linux/\*/compat\_sched.h: Add TASK\_COMM\_LEN define.

\* modules/linux/\*/compat\_kernel.h,  
modules/linux/\*/kernelStubsLinux.c: Add vsnprintf define.

\* modules/linux/\*/x86cpuid.h: Add new CPUs.

\* modules/linux/vmhgfs/vmhgfs\_version.h: Bump HGFS version.

\* modules/linux/\*/vm\_basic\_asm\_x86.h,  
modules/linux/\*/vm\_basic\_asm\_x86\_64.h,  
lib/include/vm\_basic\_asm\_x86.h, lib/include/vm\_basic\_asm\_x86\_64.h:  
Formatting fixes, and change asm directives used.

\* modules/linux/vmhgfs/module.h,  
modules/linux/vmhgfs/filesystem.c,

modules/linux/vmhgfs/bdhandler.c,  
modules/linux/\*/compat\_kthread.h: compat\_kthread fixes.

\* modules/freebsd/vmxnet/net\_compat.h,  
modules/freebsd/vmxnet/if\_vxn.c: Updates for FreeBSD 7.0.  
(Thanks to Martin Blapp for contributing to these changes.)

\* lib/misc/util\_misc.c, lib/include/loglevel\_user.h,  
lib/user/hostinfoPosix.c, lib/misc/hostname.c: Bugfix.

\* lib/unityStub/unityStub.c, lib/include/unity.h: Add stub and enums  
related to DnD support.

\* lib/unicode/unicodeSimpleTypes.c,  
lib/unicode/unicodeSimpleTransforms.c,  
lib/unicode/unicodeSimpleBase.c, lib/unicode/unicodeCommon.c,  
lib/include/unicodeTypes.h,  
lib/include/unicodeTransforms.h,  
lib/include/unicodeBase.h, lib/include/unicodeCommon.h: Add  
additional Unicode-related functions.

\* lib/sync/syncMutex.c, lib/include/syncMutex.h: Add TryLock method.

\* lib/strUtil/strutil.c: Add int64-related functions.

\* lib/string/str.c:  
Compile fix

\* lib/string/bsd\_output\_shared.c: Better handling of floating  
point on Windows.

\* lib/include/progMgr.h, lib/procMgr/procMgrPosix.c: Clarify that  
the strings are in UTF-8, do conversion as needed.

\* lib/include/posix.h, lib/misc/posixPosix.c,  
lib/misc/posixWin32.c, lib/file/filePosix.c: Add new Posix\_  
function implementations, and uncodify existing ones.

\* lib/misc/hashTable.c, lib/include/hashTable.h: Add lock-less hash  
table functions.

\* lib/misc/util\_misc.c, lib/include/w32util.h: Add a couple of  
Win32 utility functions.

\* lib/include/vm\_version.h: Add WS5 config version.

\* lib/include/vm\_atomic.h: Add typecasts to atomic operations to  
make compilers stop complaining, and expand the AtomicUseFence option.

\* lib/include/vm\_app.h: Add a couple of HGFS-related options.

\* lib/include/vix.h: Update a few errors and other macros.

\* lib/include/vixCommands.h, lib/foundry/foundryMsg.c: Change a bunch of structure members from int32 to uint32, and add a parsing function.

\* lib/include/msgfmt.h, lib/include/msg.h: Additional message-handling prototypes.

\* lib/include/guestInfoInt.h, lib/include/guestInfo.h, lib/guestInfo/Makefile.am, lib/guestInfo/guestInfoServer.c, lib/guestInfo/guestInfoPosix.c, lib/guestInfo/guestInfoPerfMonLinux.c: Add IPv6 support, and the ability to read mem stats on Linux.

\* lib/include/fileIO.h, lib/file/fileIOPosix.c: Add MacOS function related to Time Machine.

\* lib/guestApp/guestApp.c: Use Posix\_ variants of functions.

\* lib/ghIntegrationStub/ghIntegrationStub.c: Add GHI capabilities stubs.

\* lib/dnd/dndCommon.c, lib/file/file.c: Use new Unicode\_Format() function, bugfix.

\* guestd/main.c: Fix a security bug.

\* configure.ac: Allow calling libdnet 'dumbnet' for Debian systems. Detect libprocps.

2008-03-19 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.03.13).

\* vm\_version.h: Updated Tools version.

\* configure.ac: Added dynamic dnet detection and --without-dnet flag.

\* guestd/debugStdio.c, lib/include/system.h, lib/system/systemLinux.c: Modified debugging to file behavior to prepend debug strings with human readable timestamps.

\* `guestd/main.c`, `guestd/toolsDaemon.c`, `lib/conf/conf.c`,  
`lib/guestApp/guestApp.c`, `lib/include/guestApp.h`: Internationalized  
`GuestApp_GetInstallPath` and `GuestApp_GetconfPath`.

\* `lib/auth/authPosix.c`, `lib/dnd/dndLinux.c`, `lib/file/*`,  
`lib/impersonate/impersonatePosix.c`, `lib/include/fileInt.h`,  
`lib/include/posix.h`, `lib/misc/posix*.c`: Refactored, extended, and made  
use of the set of POSIX internationalization-safe function wrappers.

\* `lib/dnd/dndCommon.c`, `lib/include/dnd.h`, `lib/include/dndInt.h`,  
`vmware-user/copyPaste.c`, `vmware-user/dnd.c`: Replaced some duplicated  
UTF-8 formatting code with calls to `lib/unicode`.

\* `lib/guestInfo/guestInfoPosix.c`: Replaced the old syscall-based  
implementation of `nicinfo` with a simpler implementation that uses `dnet`.

\* `lib/guestInfo/guestInfoServer.c`, `lib/include/guestInfo.h`,  
`lib/include/guestInfoInt.h`:  
Added Win32 implementation of  
`meminfo`. POSIX implementation to follow.

\* `lib/hgfsServer/hgfsServerLinux.c`: Replaced a direct `readlink(3)` call  
with a call to the POSIX wrapper for `readlink(3)`. Relax an overeager  
`ASSERT` in `symlink` checking when using the special empty share.

\* `lib/include/codeset.h`, `lib/string/bsd_vsnprintf.c`, `lib/string/str.c`,  
`lib/unicode/unicodeSimpleOperations.c`, `lib/unicode/unicodeSimpleUTF16.h`:  
Refactored ICU routines from `unicodeSimpleUtf16.h` to `codeset.h`, which  
is now licensed under the ICU license (BSD variant).

\* `lib/include/file.h`, `lib/file/file.c`: Added function `File_StripSlashes`.

\* `lib/include/hgfsProto.h`: Removed an A acute from a comment to allow  
the file to be built on Windows systems where the default language isn't  
English.

\* `lib/include/hostinfo.h`, `lib/include/util.h`, `lib/user/hostinfoPosix.c`,  
`lib/user/util.c`, `lib/user/utilPosix.c`: More conversions to  
`lib/unicode`. Added `Util_ZeroFreeStringW` function  
for Windows in `util.h`.

\* `lib/include/msg.h`: Removed obsolete `NO_MSGFMT` macro.

\* `lib/include/unicodeBase.h`, `lib/unicode/unicodeCommon.c`,  
`lib/unicode/unicodeSimpleBase.c`: Added some more encoding functions.

\* `lib/include/vixCommands.h`, `lib/include/vixOpenSource.h`: Added another  
user credential type, some command flags, some command layouts, some

error codes, some properties, and tweaked existing commands.

\* lib/include/vixTools.h: Added VixToolsUserIsMemberOfAdministratorGroup function.

\* lib/include/vm\_assert.h, lib/include/vm\_basic\_defs.h: Move IMPLIES to vm\_basic\_defs.h. Removed some vprobes definitions.

\* lib/include/vmBackup.h, lib/vmBackupLib/scriptOps.c, lib/vmBackupLib/stateMachine.c: Added infrastructure to disable quiescing targets from a config file.

\* lib/include/vm\_basic\_asm.h: Changed \_\_GET\_CPUID2 handling for Windows.

\* lib/include/vm\_produ.h: Added VDM product.

\* lib/include/vm\_tools\_version.h: Bumped internal Tools version.

\* lib/include/win32util.h, lib/misc/hostname.c, lib/misc/util\_misc: Refactored functions to separate set of Win32 wrappers (next to the POSIX wrappers mentioned earlier).

\* lib/misc/codeset.c: Made CodeSetGetCurrentCodeSet non-static.

\* lib/misc/\*/Makefile.am: Added POSIX wrappers to build system.

\* lib/strUtil/strutil.c: Fixed bug in StrUtil\_EndsWith function.

\* lib/include/unicodeTypes.h, lib/unicode/unicodeSimpleTypes.c: Removed ISO-8859-11 encoding. Added cross-reference of IANA character set names, windows code pages, and ICU encodings.

\* lib/vixTools/vixTools.c: Impersonation tweaks.

\* modules/\*/\*/\*: Reflect header file changes from elsewhere in the source code tree.

2008-03-11 Adar Dembo <adar@vmware.com>

\* vm\_version.h: Updated Tools version.

\* modules/vmblock/linux/\*: Make vmblock build under 2.6.25-rc2. The dentry and mount objects have been moved out of struct nameidata and into the new struct path. Also, path\_release() is now path\_put().

\* modules/vmsync/linux/\*:

Make vmsync build under 2.6.25-rc2.

The same changes were needed here as in vmblock above.

2008-03-10 Adar Dembo <adar@vmware.com>

\* vm\_version.h: Updated Tools version.

\* modules/vmhgfs/linux/\*: Make vmhgfs build under 2.6.25-rc1.

The iget() function has been removed and filesystems are now expected to implement it themselves using iget\_locked().

2008-02-27 Elliot Lee <elliott@vmware.com>

\* configure.ac, guestd/Makefile.am, toolbox/Makefile.am, vmware-user/Makefile.am: Allow passing custom LDFLAGS in to build process (patch by Mike Auty).

\* Resync with internal trunk (2008.02.27).

\* guestd/foundryToolsDaemon.c, lib/vixTools/vixTools.c, vmware-user/foundryToolsDaemon.c: Win9x compat changes.

\* guestd/toolsDaemon.c: Style fixes.

\* hgfsmounter/hgfsmounter.c: Bug fixes.

\* lib/dnd/dndLinux.c, lib/dnd/dndCommon.c: Move some code to the platform-independent file, some DnDv3 support.

\* lib/include/dnd.h, lib/include/dndInt.h: DnDv3 support.

\* lib/file/file.c, lib/file/fileIO.c, lib/file/fileIOPosix.c, lib/file/fileLockPrimitive.c, lib/file/filePosix.c, lib/include/file\_extensions.h, lib/include/fileInt.h, lib/include/fileIO.h: Move functions around, Unicode fixes, misc fixes.

\* lib/foundryMsg/foundryPropertyListCommon.c: Error handling fixes.

\* lib/hgfsServer/\*.c, lib/include/hgfs\*.h, modules/freebsd/vmhgfs/\*, modules/linux/vmhgfs/\*: HGFS v3 support, updates to improve code re-use between the FreeBSD and MacOS X ports, and updates to make the Linux port build on 2.6.25-rc1 (but not rc2, yet).

\* lib/include/auth.h, lib/include/codeset.h, lib/include/hostinfo.h, lib/include/str.h, lib/include/unicode\*.h,

lib/include/vm\_basic\_types.h, lib/misc/hostname.c,  
lib/unicode/\*.c, lib/user/hostinfoPosix.c: Unicode fixes.

\* lib/include/backdoor\_def.h: Add a new command for use by the BIOS in checking the GuestOS against Darwin.

\* lib/include/dynarray.h, lib/misc/dynarray.c,  
lib/misc/Makefile.am, lib/misc/shared/Makefile.am: Add Dynarray implementation.

\*

lib/include/bsdfmt.h, lib/include/bsd\_output\_int.h,  
lib/string/bsd\_output\_shared.c, lib/string/bs\_vsnprintf.c,  
lib/string/bsd\_vsnwprintf.c, lib/string/str.c: Rework built-in printf implementation, esp. for Unicode fixes.

\* lib/include/ghIntegration.h: Shuffle types around.

\* lib/include/loglevel\_user.h, lib/include/unity.h,  
lib/syncDriver/syncDriverPosix.c, lib/user/util.c,  
toolbox/toolbox-gtk.c: Misc fixes.

\* lib/include/vmBackup.h, lib/vmBackupLib/scriptOps.c,  
lib/vmBackupLib/stateMachine.c, lib/vmBackupLib/vmBackupInt.h:  
Rework scripts for freeze & thaw operations.

\* lib/include/vm\_product.h, lib/include/vm\_version.h: Add new product defs (VMRC).

\* lib/include/vm\_tools\_version.h: Add ESX 3.5U1 product.

\* lib/include/vixCommands.h, lib/include/vix.h: Add new VIX commands and error code.

\* lib/include/win32util.h: Add misc Win32 utilities.

\* modules/\*/\*/\*: Reflect header file changes from elsewhere in the source code tree.

2008-02-13

Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.02.12).

\* configure.ac, lib/unityStub/\*, lib/ghIntegrationStub/\*,  
lib/Makefile.am, vmware-user/Makefile.am, vmware-user/vmware-user.c:  
Added lib/unityStub and lib/ghIntegrationStub. Unity and guest-host integration features for X11 guests are on the way.

\* configure.ac, guestd/Makefile.am, lib/fileUtf8/\*,  
lib/vixTools/vixTools.c, vmare-user/Makefile.am: lib/file is now fully  
internationalized. Removed unneeded lib/fileUtf8.

\* foundryToolsDaemon.c: Fixed a leak of the sync driver handle.

\* guestd/toolsDaemon.c: Send guestd's "config directory" to the VMX for  
publishing.

\* hgfsmounter/hgfsmounter.c: Port to MacOS.

\* lib/dnd/\*, lib/err/err.c, lib/file/\*, lib/include/dnd\*,  
lib/include/file\*, lib/include/unicode\*, lib/include/util.h,  
lib/unicode/\*, lib/user/utilPosix.c: More Unicodification.

\* lib/file/file.c, lib/include/file.h: Added File\_EnsureDirectory.

\* lib/foundryMsg/foundryMsg.c, lib/guestInfo/guestInfoServer.c,  
lib/misc/codeset.c,  
lib/misc/vmstdio.c,  
lib/SLPv2Parser/SLPv2MsgAssembler.c, lib/user/util.c: Removed some  
unneeded casts.

\* lib/foundryMsg/foundryThreads.c, lib/include/foundryThreads.h: Added  
FoundryThreads\_Free.

\* lib/guestInfo/\*, lib/include/guest\_os.h, lib/include/guestInfo.h:  
Refactored GetSystemBitness. Removed osNames.h.

\* lib/hgfsServer/hgfsServerLinux.c: Modified MacOS alias resolution code  
so as not to mount volumes. Made HGFS query volume code more resilient  
to failures.

\* lib/include/backdoor\_def.h: Added commands for VAssert.

\* lib/include/escape.h, lib/misc/escape.c: Escape\_Do is no longer  
declared inline.

\* lib/include/hashTable.h, lib/misc/hashTable.c, lib/misc/Makefile.am,  
lib/misc/shared/Makefile.am: Renamed from hash.[ch].

\* lib/include/iovector.h, lib/include/vm\_basic\_types.h: Added  
SectorType definition.

\* lib/include/loglevel\_user.h: Added additional log levels.

\* lib/include/msgfmt.h: Modified for use in VMKERNEL.



Added

MsgFmt\_GetArgswithBuf.

\* lib/include/msg.h: Added Msg\_AppendVob for ESX.

\* lib/include/stats\_user\*: Modified some preprocessing steps. Added SETUP\_WANT\_GETVAL to retrieve named stat counter values.

\* lib/include/str.h: Modified behavior Str\_\* family of functions for Windows.

\* lib/include/strutil.h, lib/strUtil/strutil.c: Removed Split, Grep, GrepFd, and GrepFree. Added EndsWith and DecimalStrToUInt.

\* lib/include/syncWaitQ.h, lib/sync/\*: Modified SyncWaitQ\_Add and SyncWaitQ\_Remove to use PollDevHandle fd types instead of int fd types.

\* lib/include/timeutil.h, lib/misc/timeutil.c: Added TimeUtil\_GetLocalWindowsTimeZoneIndex and some helper functions.

\* lib/include/util.h, lib/user/utilPosix.c: Added Util\_BumpNoFds.

\* lib/include/vixCommands.h: Added commands for device hotplug and remote debugging.

\* lib/include/vix.h, lib/include/vixOpenSource.h: Added some new errors and properties. Added more VM manipulation functions.

\* lib/include/vm\_atomic.h:  
Comment cleanup and added VMKERNEL-specific calls for fencing.

\* lib/include/vm\_basic\_asm\_x86\_64.h: Added inline routines to save and restore ES1.

\* lib/include/vm\_basic\_types.h: Added some types and cleaned up a bit.

\* lib/include/vm\_legal.h: Updated COPYRIGHT\_YEARS.

\* lib/include/vm\_product.h: Added hostd service name.

\* lib/include/x86cpuid.h: Cleaned up the file and added some definitions for Penryn processors.

\* lib/misc/codeset.c: Added new UTF-16 --> UTF-8 conversion routine.

\* lib/misc/util\_misc.c, lib/user/util.c: Moved Util\_GetCurrentThreadId and friends to util\_misc.c.

- \* lib/procMgr/procMgrPosix.c: Cleaned up some code and reworked asynchronous process execution so as to properly track the grandchild's pid instead of the child's pid.
- \* lib/string/bsd\*: Reorganized BSD formatter.
- \* lib/string/str.c: Updated unit tests. Added some Windows corner case behavior for Str\_Vsnwprintf.
- \* lib/strUtil/strutil.c: Fixed some corner cases in existing functions that call strtoul.
- \* lib/vixTools/vixTools.c: Changed signature of VixToolsImpersonateUser. Changed error code handling in a few places.
- \* modules/freebsd/vmhgfs\*: Refactored a lot of code so that it can be safely reused within the MacOS vmhgfs module.
- \* modules/\*/\*/kernelStubs\*: Removed dead System\_Uptime function.
- \* modules/linux/\*/compat\_wait.h: Reworked VMW\_HAVE\_EPOLL macro. Added waitqueue helper macros for older kernels.
- \* modules/linux/vmhgfs/file.c, modules/linux/vmhgfs/fsutil.\*, modules/linux/vmhgfs/inode.c: Added HgfsSetUidGid function and used it to preserve uid/gid after creating a directory.
- \* modules/linux/vmhgfs/vmhgfs\_version.h: Bumped driver version.
- \* modules/linux/vmsync/compat\_workqueue.h: Basic implementation of work queues and delayed work queues (using taskqueues and timers) for older kernels.
- \* modules/linux/vmsync/sync.c: Modified internal state to use new compatible work queue implementation.
- \* modules/linux/vmxnet/compat\_ioport.h, modules/linux/vmxnet/compat\_netdevice.h, modules/linux/vmxnet/compat\_pci.h, modules/linux/vmxnet/compat\_skbuff.h, modules/linux/vmxnet/vmxnetInt.h: Added and refactored compatibility macros for use in vmxnet3 and vmci sockets modules.
- \* modules/linux/vmxnet/vmxnet.c: Hide some kernel functions behind compatibility macros.

2008-01-23 Adar Dembo <adar@vmware.com>

\* Resync with internal trunk (2008.01.08).

\* configure.ac, guestd/Makefile.am, hgfsclient/Makefile.am,  
lib/Makefile.am, toolbox/Makefile.am, vmware-user/Makefile.am:  
integrated lib/unicode for internationalizing strings.

\* guestd/main.c: Stopped using pgrep for finding existing instances  
of guestd. Removed ancient bandwidth test code.

\* guestd/toolsDaemon.c: Moved initial send of the guest's uptime from  
when guestd sends its version to when guestd registers its  
capabilities.

\* lib/file/\*, lib/include/file\*.h : Massive overhaul of lib/file to  
integrate the new unicode strings that are i18n-safe. Quite  
a bit of  
cleanup and refactoring as well.

\* lib/file/file.c: Addition of File\_PrepndToPath function.

\* lib/file/fileIOPosix.c: Addition of FileIO\_SetExcludedFromTimeMachine  
and FileIO\_PrivilegedPosixOpen functions.

\* lib/fileUTF8/fileUTF8Linux.c, lib/include/fileUTF8.h: Removal of some  
casts and addition of FileUTF8\_GetSize function.

\* lib/foundryMsg/foundryMsg.c, lib/misc/vmstdio.c,  
lib/SLPv2Parser/SLPv2MsgAssembler.c: Addition of some casts.

\* lib/foundryMsg/foundryPropertyListCommon.c: Robustified some error  
cases.

\* lib/foundryMsg/vixTranslateErrOpenSource.c,  
lib/include/vixOpenSource.h: Added VIX\_E\_OUT\_OF\_MEMORY error code.  
Added Vix\_TranslateCOMError function. ADded VIX\_DEBUG macro.

\* lib/guestInfo/guestInfoServer.c, lib/include/guestInfo.h: Added some  
casts and refactored some functions. Also fixed a crash that hinders  
backwards compatibility.

\* lib/hgfs/cpNameUtil.c, lib/hgfs/cpNameUtilLinux.c,  
lib/hgfsBd/hgfsBd.c, lib/include/cpName.h, lib/include/cpNameLite.h,  
lib/include/escBitvector.h,  
lib/include/hgfsUtil.h,  
lib/message/messageBackdoor.c, lib/message/message.c,

lib/message/messageStub.c, lib/rpcout/rpcout.c,  
modules/freebsd/vmhgfs/kernelStubs.h: Made safe for inclusion in MacOS  
kernel module code.

\* lib/include/backdoor.h: Refactored some type definitions.

\* lib/include/bsd\_output\_int.h, lib/include/safetime.h,  
lib/string/bsd\_output\_shared.c: Made safe for Win64 builds.

\* lib/include/dynbuf.h: Added DynBuf\_AppendString function.

\* lib/include/err.h: Assorted cleanup.

\* lib/include/escape.h, lib/misc/escape.c: Converted Escape\_Do to be  
inline. Some cleanup.

\* lib/include/guest\_os.h: Assorted cleanup.

\* lib/include/hash.h, lib/misc/hash.c, lib/misc/Makefile.am,  
lib/misc/shared/Makefile.am: Added basic hash table implementation.

\* lib/include/hostinfo.h, lib/user/hostinfoPosix.c: Refactored and  
added several timekeeping functions.

\* lib/include/localconfig.h, lib/include/util\_shared.h: Modified  
statements  
for include check.

\* lib/include/log.h: Changed the value of some macros when debugging.

\* lib/include/loglevel\_defs.h: Refactored some code, added macros for  
use in the VMM.

\* lib/include/loglevel\_user.h: Added loglevels for some new components.

\* lib/include/msgfmt.h: Added new functions.

\* lib/include/msg.h: Added new Msg\_LocalizeList function.

\* lib/include/netutil.h: Modified prototypes for two Windows-only  
functions.

\* lib/include/preference.h: Added new Preference\_GetInt64 and  
Preference\_SetFromString functions.

\* lib/include/strutil.h, lib/strUtil/strutil.c: Cleaned up and added  
some new functions.

- \* lib/include/su.h: Cleanup.
  
- \* lib/include/syncMutex.h, lib/sync/syncMutex.c: Added NetWare implementation of some synchronization primitives.
  
- \* lib/include/unicode\*, lib/unicode/\*: New library for handling Unicode-aware strings.
  
- \* lib/include/util.h, lib/user/util.c: Assorted refactoring and addition of some new functions, one related to backtracing.
  
- \*
- lib/include/vixCommands.h: New commands for vprobes, replay, message dialogs, and others, plus cleanup of some existing commands.
  
- \* lib/include/vm\_assert.h: Added IMPLIES macro.
  
- \* lib/include/vm\_atomic.h, lib/include/vm\_basic\_asm.h: Refactored for safe Win64 builds.
  
- \* lib/include/vm\_basic\_defs.h: Added compatibility code for \_\_va\_copy.
  
- \* lib/include/vm\_basic\_types.h: Added FMTH for printing the value of handles. Set a new #pragma to ignore size\_t truncation warnings on Windows. Added several other macros, as well as a ssize\_t definition for some versions of BSD.
  
- \* lib/include/vm\_legal.h: Added more patents to the patent string.
  
- \* lib/include/vm\_product.h: Added new macros for some products.
  
- \* lib/include/vm\_tools\_version.h: Added macros for certain older Tools versions and for PRODUCT\_BUILD\_NUMBER refactoring.
  
- \* lib/include/vm\_version.h: Tweaked some product expiration dates and versions. Refactored many uses of BUILD\_NUMBER to PRODUCT\_BUILD\_NUMBER.
  
- \* lib/include/x86cpuid.h:  
Tweaked definition of RDTSCP flag. Refactored BIT\_MASK macro to VMW\_BIT\_MASK.
  
- \* lib/misc/base64.c: Modified calling contract for Base64\_EasyEncode.
  
- \* lib/misc/codeset.c: Tweaked casts and preprocessor conditioning.
  
- \* lib/misc/idLinux.c: Added IdAuthCreateWithFork and reworked several other functions to work around a bug in Apple's detection of GUI processes.

- \* lib/misc/util\_misc.c: Moved W32Util\_GetLongPathName and W32Util\_LookupSidForAccount elsewhere.
- \* lib/rpcin/rpcin.c: Addition of a ping GuestRPC callback.
- \* lib/string/str.c: Removed a comment.
- \* lib/sync/syncWaitQPosix.c: Added code to disable a workaround for a MacOS bug when appropriate (it was fixed in Leopard).
- \* lib/vixTools/vixTools.c: Refactored some code, added code to modify the guest's networking configuration, added some casts, and added code to prevent renaming a file to itself.
- \* modules/freebsd/\*/Makefile, modules/linux/\*/Makefile.normal: Set a make variable so the module file will be build in the parent directory. Removed some unused rules.
- \* modules/freebsd/vmhgfs/kernelStubsBSD.c, modules/linux/vmhgfs/kernelStubsLinux.c: Removed unused function.
- \* modules/linux/\*/include/driver-config.h: Added check to prevent uintptr\_t from being declared twice.
- \* modules/linux/vmblock/linux/filesystem.c, modules/linux/vmblock/Makefile.kernel: Added check for newer kernels where the slab allocator's constructor function expects three arguments. Makes it work with 2.6.25-rc1 (but not rc2, yet).
- \* modules/linux/vmblock/linux/vmblock\_version.h: Bumped module version.
- \* modules/linux/vmhgfs/filesystem.c, modules/linux/vmhgfs/inode.c, modules/linux/vmhgfs/module.h, modules/linux/vmhgfs/page.c: Added support for writeback caching in conformant kernels.
- \* modules/linux/vmhgfs/vmhgfs\_version.h: Bumped module version.
- \* modules/linux/vmxnet/vmxnetInt.h: Renamed a type and removed the inclusion of unnecessary headers. Pruned said headers from codebase.

2007-11-15

Elliot Lee <elliott@vmware.com>

- \* Bandsaw release (2007.11.15).
- \* configure.ac: Handle building modules for multiple OS's. Improve

X detection to allow building --without-x. Improve Gtk+ detection. Detect libdnet on Solaris. Detect which -Wwarning flags the compiler can handle.

\* vmware-user/foreignVMToolsNetworking.c, lib/vixTools/vixTools.c, guestd/foreignVMToolsNetworking.c, lib/include/netutil.h, lib/include/guestInfo.h, lib/netUtil/netUtilLinux.c, lib/include/guestInfoInt.h, lib/guestInfo/guestInfoPosix.c, lib/guestInfo/guestInfoServer.c: Move to new NicInfo structures.

\* vmware-user/foundryToolsDaemon.c, guestd/foundryToolsDaemon.c: Make sure requestMsg is not NULL before looking inside it.

\* guestd/main.c: Cleanup of HGFS pserver and mounting code. Check for some type of signal when sending an RPC.

\* guestd/toolsDaemon.c, vmware-user/resolution.c: Have the guest tell the host whether screen resolution changes should be sent, instead of having the host guess it based on the OS type set in the .vmx file. Better timeout checking to avoid problems when host & guest time diverge.

\* hgfsmounter/hgfsmounter.c: FreeBSD support. Fixes to compile on old systems.

\* lib/backdoor/backdoor.c: Tweak for FreeBSD kernel modules.

\* lib/include/mntinfo.h, lib/dnd/dndLinux.c, lib/wiper/wiperPosix.c, lib/syncDriver/syncDriverPosix.c: Fixes to compile on new systems w/gcc 4.2.

\* lib/err/err.c, lib/err/errPosix.c, lib/err/Makefile.am: Move Err\_Errno2String function into POSIX-specific source file.

\* lib/file/fileIOPosix.c: Handle EDQUOT if applicable. Fixes to compile on new systems where SYS\_\_lseek may not be available. Better reporting of errors, by translating errno into FILEIO\_\* error codes.

\* lib/file/fileLockPosix.c: Fixes to compile on old systems. Add a bunch of functions to the FileLock\* API.

\* lib/file/fileLockPrimitive.c, lib/include/fileInt.h: Bunch of file locking cleanups and bug fixes.

\* lib/file/filePosix.c:

Bunch of MacOS-related fixes. Add

File\_GetTimes(), FilePosixGetParent(), FilePosixGetBlockDevice(),  
etc.

\* lib/fileUtf8/fileUTF8Linux.c: Add FileUTF8\_GetTimes() function.

\* lib/foundry/foundryMsg.c, lib/include/vixCommands.h: Add  
VIX\_USER\_CREDENTIAL\_HOST\_CONFIG\_HASHED\_SECRET credential type, and  
a bunch of VIX commands relating to record-replay.

\* lib/foundryMsg/vixTranslateErrOpenSource.c: Translate a couple  
more error codes.

\* lib/guestInfo/guestInfoPosix.c, lib/guestInfo/Makefile.am: Use  
libdnet on Solaris to retrieve networking info.

\* lib/hgfs/cpNameUtil.c, lib/hgfs/cpNameUtilInt.h,  
lib/hgfs/cpNameUtilLinux.c: Couple more CPName <-> UTF8 conversion  
routines. Some MacOS changes as well.

\* lib/hgfs/hgfsUtil.c, lib/include/hgfs.h,  
modules/linux/vmhgfs/fsutil.c: Handle ENAMETOOLONG.

\* lib/hgfs/staticEscape.c, lib/hgfs/hgfsBd.c: Handle FreeBSD as  
well.

\* lib/hgfsServer/hgfsServer.c: Tie in the cpNameUtil UTF8 changes  
on MacOS.

\* lib/hgfsServer/hgfsServerLinux.c:  
Make the getdents() wrapper  
work on a wider range of Linux systems. Add "alias" resolution on  
MacOS, and tie in the cpNameUtil UTF8 changes on MacOS.

\* lib/hgfsServer/hgfsServerPolicyGuest.c: Handle FreeBSD.

\* lib/include/backdoor\_def.h: Add BDOOR\_CMD\_LAZYTIMEREMULATION and  
BDOOR\_CMD\_BIOSBBS.

\* lib/include/str.h, lib/include/bsd\_output.h,  
lib/include/bsd\_output\_int.h: include compat\_stdarg.h, change  
vsnwprintf prototype, add HAVE\_BSD\_WPRINTF define, other compat  
fixups.

\* lib/include/cpNameUtil.h, lib/include/codeset.h,  
lib/misc/codeset.c: Changes to correspond to cpNameUtil UTF8  
changes.



- \* lib/include/compat/compat\_stdarg.h: New header for doing stdarg easily across platforms.
- \* lib/include/cpName.h: FreeBSD fixes.
- \* lib/include/dnd.h: Add Dnd\_SetClipboard and Dnd\_GetFileList().
- \* lib/include/escBitvector.h: FreeBSD fixes.
- \* lib/include/file.h, lib/include/fileUTF8.h: Add new MacOS routines and File\_GetTimes/FileUTF8\_GetTimes.
- \* lib/include/hgfsProto.h:  
Explanation of the whole cpNameUtil and codeset UTF8 changes and how they tie in with HGFS.
- \* lib/include/hgfsUtil.h: Random compatibility changes.
- \* lib/include/loglevel\_user.h: Add a few LOGLEVEL\_VAR definitions.
- \* lib/include/msg.h: s/USE\_MSGFMT/NO\_MSGFMT/
- \* lib/include/osNames.h: Add Windows 2003 Datacenter Edition, and user-visible 64bit suffix macro.
- \* lib/misc/random.c, lib/include/random.h: Add Random\_Quick() and Random\_QuickSeed() routines.
- \* lib/misc/idLinux.c, lib/include/su.h: Add Id\_AuthGetLocal() and Id\_GetAuthExternal() routines, and compat fixes.
- \* lib/misc/timeutil.c, lib/include/timeutil.h: Add TimeUtil\_UnixTimeToNtTime() routine.
- \* lib/include/util.h: Add a couple of MacOS routines.
- \* lib/include/vmBackup.h, lib/vmBackupLib/stateMachine.c: add a couple of structure elements for Windows backup fixes.
- \* lib/include/vm\_basic\_asm.h: fixes for reading TSC on 64-bit platforms.
- \* lib/include/vm\_basic\_defs.h: Add other va\_copy macros.
- \*  
lib/include/vm\_basic\_types.h: Fixes for compiling on a wide range of systems.

- \* lib/include/vm\_legal.h: Change the PATENTS\_STRING
- \* lib/include/vm\_product.h: Add "License Infrastructure" product.
- \* lib/include/vm\_tools\_version.h: Change tools versions listed for various upcoming product releases.
- \* lib/include/vm\_version.h: Update the versions.
- \* lib/include/x86cpuid.h: Define more CPU flags & fields, add new CPU models. Fixes for fully writable TSC detection.
- \* lib/message/message.c, lib/message/messageBackdoor.c: Fixes for FreeBSD.
- \* lib/misc/util\_misc.c: Handle MacOS.
- \* lib/rpcIn/rpcin.c: Fail a badly-formed RPC instead of ASSERT()'ing into oblivion.
- \* lib/string/bsd\_vsnprintf.c: Various fixes to synchronize with bsd\_vsnwprintf.c.
- \* lib/string/Makefile.am, lib/string/shared/Makefile.am, lib/string/str.c lib/string/bsd\_vsnwprintf.c: New file to implement vsnwprintf() for compat purposes.
- \* lib/vixTools/vixTools.c: New FileUTF8 routines.
- \* Makefile.am,  
modules/Makefile.am: --without-x fixes, add xferlogs, move kernel module building into separate Makefile.am
- \* modules/freebsd/\*: Add FreeBSD kernel modules (vmblock, vmhgfs, vmmemctl, vmxnet).
- \* modules/linux/\*/include/compat\_\*.h,  
modules/linux/\*/autoconf/cachector.c,  
modules/linux/\*/autoconf/cachecreate.c,  
modules/linux/\*/backdoor.c, modules/linux/vmhgfs/filesystem.c,  
modules/linux/vmhgfs/hgfsBd.c, lib/procMgr/procMgrPosix.c,  
lib/rpcOut/rpcout.c, lib/user/util.c, lib/vmCheck/vmcheck.c,  
libguestlib/Makefile.am, lib/deployPkg/runDeployPkgPosix.c,  
lib/include/vm\_atomic.h: Compat fixes.
- \* modules/linux/\*/kernelStubs.h: Update for FreeBSD.
- \* modules/linux/\*/include/\*.h, modules/linux/\*/backdoor\_def.h,

modules/linux/\*/cpName.h, modules/linux/\*/hgfs.h,  
modules/linux/\*/hgfsProto.h, modules/linux/\*/hgfsUtil.[ch],  
modules/linux/\*/kernelStubsLinux.c,  
modules/linux/\*/messageBackdoor.c, modules/linux/\*/message.c,  
modules/linux/\*/rpcout.c, modules/linux/\*/rpcin.c,  
modules/linux/\*/staticEscape.c,  
modules/linux/\*/vm\_basic\_asm.h,  
modules/linux/\*/vm\_basic\_defs.h, modules/linux/\*/vm\_basic\_types.h,  
modules/linux/\*/x86cpuid.h, modules/linux/\*/compat\_\*.h: Pull in  
updated files from main source tree.

\* modules/linux/\*/Makefile.kernel: Remove CC\_WARNINGS/CC\_OPTS  
gunk.

\* modules/linux/\*/README, modules/linux/\*/Makefile.normal: Build  
foo.o driver by default on systems with VM\_KBUILD=no.

\* modules/linux/vmhgfs/vmhgfs\_version.h: Updated VMHGFS driver  
version.

\* modules/linux/vmmemctl/os.[ch],  
modules/linux/vmmemctl/vmballoon.c: Implement and use os\_yield()  
to deprioritize the Balloon\_Deallocate operation.

\* modules/linux/vmsync/\*: New sync driver to make VM snapshots  
consistent.

\* modules/linux/vmxnet/bpf\_meta.h: New file.

\* modules/linux/vmxnet/net\_dist.h: Update NET\_MAX\_IMPL\_PKT\_OVHD  
value.

\* modules/linux/vmxnet/vm\_device\_version.h: Mention VMXNET3

\* modules/linux/vmxnet/vmkapi\_status.h: Updated VMK\_ERR codes.

\* modules/linux/vmxnet/vmkapi\_types.h:  
Add VMK\_CONST64(U) macros.

\* modules/linux/vmxnet/vmxnet2\_def.h,  
modules/linux/vmxnet/vmnet\_def.h,  
modules/linux/vmxnet/vmxnet\_def.h,  
modules/linux/vmxnet/vmxnetInt.h, modules/linux/vmxnet/vmxnet.c:  
Add (optional) BPF support.

\* modules/linux/vmxnet/vmxnetInt.h, modules/linux/vmxnet/vmxnet.c:  
Add vmxnet\_link\_check to propagate device link status to netdev.

\* common/vm-support: New script to gather support info from a VM.

\* scripts/\*/\*-default: New poweron/poweroff/suspend/resume scripts for a VM. Add support for dropping user-provided scripts into a subdirectory.

\* toolbox/toolboxAbout.c: Eliminate warnings about unused variables.

\* toolbox/toolboxShrink.c: Update wording of message.

\* toolbox/copyPaste.c: Try cutting & pasting UTF8 text if we can.

\* xferlogs/\*: New log transfer utility.

2007-10-26 Elliot Lee <elliot@vmware.com>

\* Initial import of 2007.09.04-56574 code ("Axe" release).

\* Import 2007.10.08 snapshot, which includes patches to fix the --without-x flag, and compilation with gcc 4.2.

Found in path(s):

\* /opt/cola/permits/1771074730\_1692703586.08025/0/clearlinux-pkgs-open-vm-tools-10-3-5-23-0-ge2ce082-tar-gz/clearlinux-pkgs-open-vm-tools-e2ce082/ChangeLog

# 1.423 procps 3.3.11

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- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the



Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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# 1.424 pydantic 1.8.0

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## 1.425 rtmpdump

a107cef9b392616dff54fabfd37f985ee2190a6f

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Version 2.1, February 1999

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The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative

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## 1.426 runc 1.1.8

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Protocol Buffers for Go with Gadgets

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<https://github.com/golang/protobuf>

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